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[OFFICIAL NOTICE.]

Twenty-ninth Annual Meeting, American Gas Light Association.

OFFICE OF THE SECRETARY,
NEW YORK, Sept. 10th, 1901.

There will be an annual meeting of the American Gas Light Association held at Boston, Mass., October 16th to 18th, 1901.

The meeting will be called to order by the President, Mr. Edward G. Pratt, of Des Moines, Ia., at 10 A.M., on Wednesday, October 16th.

The meeting hall will be Steinert Hall, Boylston street, near Park square, Boston, Mass.

The headquarters will be at the Hotel Brunswick, corner Boylston and Clarendon streets, Boston, Mass.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The Hotel Brunswick is conducted on the American plan, and rates for rooms will be as follows:

Rooms without bath, occupied by one person, $4 per day; occupied by two persons, $3.50 per day for each person. Rooms with bath, occupied by one person, $5 per day; occupied by two persons, $4.50 per day for each person.

While the Brunswick prefers not to take any of the members of the Association on the European plan, and has not made any rate on this plan, members who are especially desirous of adopting it may be able to make special arrangements by communicating with the hotel management.

The Lenox Hotel, corner of Boylston and Exeter streets, makes the following rates on the European plan: Single rooms, $1.50, $2 and $2.50; single rooms with bath, $2.50, $3 and $3.50. Double rooms, $2.50, $3 and $4; double rooms with bath, $3, $3.50 and $5. Both hotels are within 5 minutes' walk from Steinert Hall.

Other hotels at Boston are as follows: Copley Square Hotel, Huntington avenue and Center street; Hotel Thorndike, Boylston and Church streets; Hotel Touraine, Boylston and Tremont streets; Adams House, Washington street, south of West street; Parker House, Tremont and School streets; Young's Hotel, Court street.

The Roll Call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary. Remember, all applications must be in the Secretary's hands by October 6th, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"The Analysis of Gas Accounts," by Mr. Paul Doty, Detroit, Mich.

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"What is a Gas Company's Business?" by Mr. Frank D. Moses, Trenton, N. J.

"Tar and Water from Water Gas," by Mr. Wm. E. McKay, Dorchester, Mass.

"Retort Ovens as Producers of Illuminating Gas," by Mr. T. Littlehales, Syracuse, N. Y.

"Further Notes on Retort House Practice," by Mr. E. H. Earnshaw, Philadelphia, Pa.

A paper by Mr. A. B. Slater, Jr., Providence, R. I., and a paper by Mr. C. F. Prichard, Lynn, Mass. The titles of these last 2 papers have not yet been announced.

If the papers are of a sufficiently high standard the Beal Medal will be awarded to the author of the best paper presented; the question of which is best to be decided by the proper committee.

The officers are endeavoring to arrange for a lecture on some subject of interest to the members to be delivered during the meeting.

In addition to the papers and lecture, the Report of the Research Committee will deal with the question of "Pipe Standards" referred to the Committee at the last meeting, and with other subjects that should give rise to a good discussion.

During the days of the meeting all the announcements will be posted on the bulletin boards in the hotel. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the "Year-book" containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that, if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Boston, Mass., but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

The arrangements for the entertainment of the members and the ladies accompanying them during the meeting have not yet been completed. The entertainment will, however, include a banquet at the Brunswick, the evening of Thursday, October 17th, and an excursion of some kind on Friday, October 18th. It is also probable that the ladies will be taken on a trip around Boston, during which they will be in charge of a thoroughly competent guide and be shown all the places of historic interest. A complete programme of the entertainment will be given in an announcement to be sent out later.

Any members having questions which they desire to put into the Question Box should send the same to the Secretary as soon as possible, in order to give him an opportunity to have them printed and distributed to the members before the meeting so as to secure for them careful attention.

ALFRED E. FORSTALL, Secy.

BRIEFLY TOLD.

THE DEATH OF THE PRESIDENT.—Never in the history of any country has so grand a tribute to the memory of a chief executive been shown as that accorded to our late President. The demonstration of sorrow, earnest, profound and sustained, welled from all classes and creeds in magnificent volume, and is the mighty testimonial of the nation to the sway which the President had over the respect and affections of those whom he so simply and effectively ruled. In sincere sorrow we join with our fellows in a simple expression of our knowledge of his merit and worth, and in so doing we have the satisfaction of knowing that the world is better for his having lived in it.

THE TWENTY-NINTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.—Secretary Forstall's official notice respecting the 29th meeting of the American Gas light Association, which is to be held in Boston next month, forcefully shows that the meeting is bound to be a successful one in every respect. Boston, in mid-October, is a delightful place in which to dwell, even for a short time, for the weather conditions which then usually prevail are of the finest order. The meeting hall is admirably adapted for the purposes of the sessions, and the place selected for headquarters (the Hotel Brunswick) could not be improved upon. The hall and headquarters, although not under one roof, are close enough to do away with any thought of inconvenience as to getting from one to the other. The paper list is an excellent one, as a mere glance at the titles of the themes selected and a look at the names of the authors will prove. It may be taken for granted that the Association's clever President, Mr. Edward G. Pratt—who, by-the-way, although he has long been a resident of Des Moines, Ia., in the early days of his gas career was a New Englander—will in his address have much of interest for gas men to consider. Then, still further enhancing the technical side of the meeting, we are to have reports from some standing committees on subjects of much practical interest to the fraternity. It goes without saying that the social chapters of the convention will be of the most enjoyable sort, for are not the men of New England entertainers of the royal order? Although there is no dearth of hotel accommodations in Boston, it is nevertheless well to be on the safe side by securing quarters well in advance of the time of their use. Those who propose to take membership in the Association this fall should pay due heed to the admonition from the Secretary that the applications on such account must be in his hands not later than October 6th.

THE FINDINGS IN THE DAMAGE SUITS, ARISING FROM THE EXPLOSION IN THE BOSTON SUBWAY.—A correspondent in Boston forwards the following: "Former Judge Dunbar, auditor or referee in the subway explosion cases, filed his reports in the office of the Clerk of the Superior Court, the forenoon of the 14th inst. He found that the Boston Gas Light Company and the Edison Electric Illuminating Company were each guilty of negligence and both equally liable for the explosion at the corner of Boylston and Tremont streets, March 4, 1897. The finding is in the nature of a great surprise, inasmuch as Judge Dunbar finds the Edison Electric Illuminating Company equally liable with the Boston Gas Light Company. At the trial of the case of Wolf Koplan *vs.* the Boston Gas Light Company and others, tried in the Superior Court some months ago, the contention of the Gas Company was that the explosion was caused by the gas generated in the tubes of the Edison Company, but the jury found the Gas Company alone liable. Judge Dunbar, however, finds the contention of the Gas Company should be sustained. Judge Dunbar says: 'Upon all the evidence I find that the Boston Gas Light Company and the Edison Electric Illuminating Company were each guilty of negligence, and that the negligence of these two defendants combined produced the explosion. There remains the question whether these two defendants are jointly liable in this action, and it is a question not free from doubt and difficulty. There is sufficient evidence of negligence to charge either of the defendants separately, even if no notice of the presence of gas in the cavity on the morning of the explosion had come to either. There is sufficient evidence to charge the Gas Company separately for the failure of its employees to attend to the leak after notice of it had been sent to its office. I rule for the purposes of this case that both are jointly liable, and upon the question of liability find for the plaintiff against both the Boston Gas Light Company and the Edison Illuminating Company.' As to the liability of the West End Street Railway Company, Judge Dunbar finds that the Company is not liable. He says: 'No other ground for holding the West End Street Railway Company liable than the ignition of the explosive mixture by a spark from one of its cars was pressed at the hearing. Upon consideration of it all (the evidence) I am not satisfied that this Company was negligent, and I find it is not liable in this action.' There are about 100 suits now pending in the Superior Court arising out of the subway explosion which took place at the corner of Tremont and Boylston streets, March 4, 1897. The aggregate amount of damages claimed exceeds $1,000,000. After the trial of the Koplan case the Supreme judicial court overruled exceptions taken by the Gas Company, but the case or cases had then assumed such a posture that it was deemed expedient to try anew the whole matter. To save time it was deemed advisable to appoint an auditor to hear the cases, and Ex-Judge James R. Dunbar was induced by all parties interested to act as such. It being generally understood that his findings would have great weight in determining many of the disputed points and operate as a final settlement of many of them. The cases can, however, still be tried before a jury, and the auditor's report is, under the statute, prima facie evidence only for the party in whose favor it is."

THE GAS SECTION OF THE INTERNATIONAL ENGINEERING CONGRESS.—Mr. O. N. Guldlin, President of the Western Gas Construction Company, of Fort Wayne, Ind., has just returned from a three months' outing in Europe. He reports that among the many enjoyable experiences that were his on the trip, the most enjoyable was his attendance at the sessions of the International Engineering Congress, held in Glasgow, Scotland, the first week of this month, and the results thereof. Section VIII. of the Congress was devoted to expositions regarding gas engineering, and its success was quite as complete as that gained by any of the other sections. Section VIII. was presided over by Mr. Geo. Livesey, of London, and he directed the proceedings like the Master that he is. His inaugural address is reprinted by us this week. It is well worth studying.

[Prepared for the JOURNAL.]

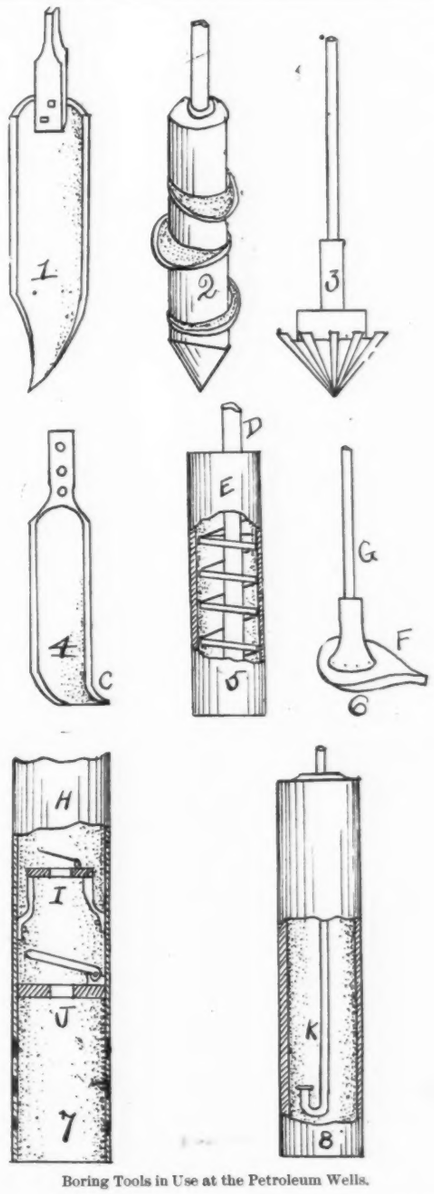
Mechanics of Oil Well Boring.

[By ENGINEER.]

As the extension of the petroleum well industry in the United States during the past few years has developed considerable interest in the mechanical side of the work for those interested in lighting matters, I shall, in this article, give a brief analysis of the arts of well boring and kindred matters relating to the industry. There are several systems of modern well boring in use in America. The Americans utilize what is known as the rope system of well boring much greater than any other system, but your correspondent witnessed practically all of the different methods in use in various oil well regions where oil is pumped from the ground for purposes of supplying the illuminating oil markets of this and other countries. There are two great divisions of boring in use. These may be termed the rotary systems, in which augers are used that are revolved and force a cavity through the strata by cutting into the same. Then there is the "shock" or "jar" method, which is performed in various ways with a rope caused to elevate and permit to fall a cutting tool. Then there are some free-falling systems, and combination devices in use which can be classed under the head of the "jar" systems.

The rotary systems for boring for oil in different parts of the world involve the use of some of the tools illustrated in Figs. 1 to 6. I saw all of these descriptions of boring tools in service in different places, and during the past few months I visited the oil fields of California and intervening States, at present being in the oil districts of New York State. I also went to some of the oil sections of Pennsylvania. The hydraulic system of drilling is in vogue in some places, also systems in which the drills or the cutting, free-falling tools are manipulated with electrical power. The rotary systems are used chiefly in sections where the earth will not permit the use of some of the other methods of boring. The rotary drill can be caused to force a passage through hard and irregular rock or strata. There is no rock hard enough to resist the penetrating influence of the crown drills, and the holes are bored only the size desired for the casing. If the earth is sandy and extremely soft, as is frequently the case, the rotary system is substituted for other descriptions of boring, more adaptable to the conditions. At first, the rotary augers were adaptable only for sandy deposits, as the tools were mostly suitable for forcing a passage through light materials. In recent years the rotary system has been rendered fitted for hard substance penetration by supplying the boring ends of the cutting tools with crowns. These crowns are for extending the end of the tool to increased diameter, so that the boring end may have free play. Also to provide the boring end with suitable movable steel teeth with a fine, saw-edge character. In Fig. 1 is shown the ordinary revolving auger which is designed for rotary boring in soft ground. It would not do for rock work, of course, nor would the spirally arranged tool in Fig. 2, although this tool is used in harder deposits than the first. In Fig. 3 is shown a type of reamer used in connection with the rotaries, for the purpose of making the bore even and for clearing it out for a more open passage for the boring tool. The boring tool may be elevated at intervals and the bore reamed out. In Fig. 4 is another type of tool which is fitted with a cutting point *C*, which point removes the earth and causes it to be scooped into the hollow of the tool. These forms of tools are raised with the rods when the tool hollow is filled with sands. In some places the sand pumps are employed for this service. I also saw devices on the plan of that in Fig. 5 for conveying the loosened sands to the top of the bore. The affair is constructed with casing or tubing, and is a little smaller than the diameter of the bore. The tube is marked *E*, and inside of this tube is the worm, or spirally-fitted shaft *D*. The device is lowered to the bottom of the bore where the loose sands and earthy matters are deposited, and the screw operated to work the material upward through the tube to the surface, where the debris is carted off. Another form of revolving instrument for working the sands free at the base of the hole is shown in Fig. 6, consisting of the rotary shaft *G*, and the flat, scoop-knife *F*. The latter is shaped so as to present a cutting edge to the bottom and slice off the soil in shavings. This of course cannot be used in rocky soil. It is suitable for practical service only in sandy deposits.

Sand pumping devices have been put into use at the oil wells to a considerable extent in recent times. I saw sand pumps at every well, so to speak. Fig. 7 shows a form of pump utilized in some places with good results. The tube or case *H* is sheet metal with laps riveted. There are double valves, *I* and *H*, and when the pump cylinder is lowered into the hole, until the loose material at the base is reached, the pump valve rod



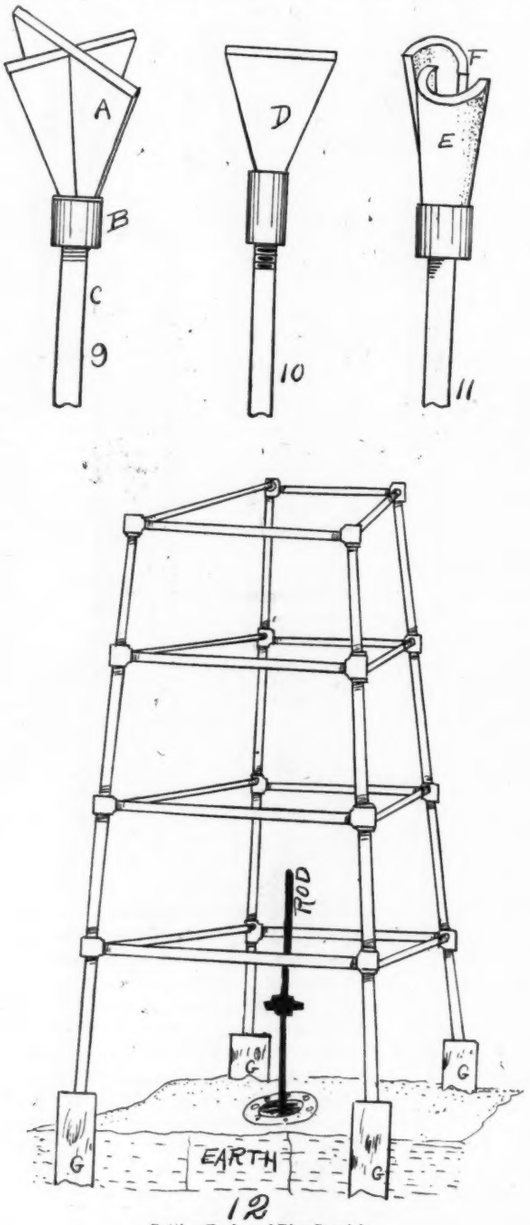
Boring Tools in Use at the Petroleum Wells.

is lifted, causing the piston head to rise, the suction of which causes the sands to enter through both the valves. As soon as the cylinder is filled the pumping ceases, and the valves *I* and *J* close of their own weight, holding the sands above. The cylinder is then lifted out and the contents dumped. Then the cylinder is lowered again for a repetition of the work, thus clearing the bore of sand. The device in Fig. 8 is sometimes used for clearing out the bottom of a well of oil, loose sands and other materials. The tube is metal and about the same diameter as the bore. Inside of this tube is a steam jet pipe *K*, which is turned up at the end. The cylinder is let down into the bore and the steam jet opened. The lower part of the cylinder is open, and as it does not reach close to the bottom of the bore, there is space for the loose matter in the hole to enter into the cylinder and be blown up with the currents of water, steam and other free stuff.

The system of drilling with steam power and ropes is, of course, very advantageous trom the speed standpoint, for the work is performed quickly. The lack of stiff rods, however, as used in other systems, makes the cutting tool liable to take an untrue course. This accounts for much of the loss of time in reboring crooked holes in wells. I saw a number of bores refilled and packed for a redrilling because of deviation of the original bore. Figs. 9, 10 and 11 show the common tools used with ropes, free-falling devices, etc.; but, of course, there are a number of others of similar pattern. In Fig. 9 is an "X"-shaped pattern, which is serviceable, as the blades cross, as at *A*, being fitted into a head *B*, which head-piece is carried on the lower end of the rod *C*. In Fig. 10 is another type of cutting tool with the single blade *D*,

for service. In Fig. 11 is an oval-end shaped tool, with the ovals marked *E* and *F*. A manilla rope is usually used for these tools, and the rope runs up over the necessary cylinders for imparting the up-and-down motion required for causing the edges of the tools to rise and fall on the bottom of the bores and thus effect the chipping and cutting. The walking beam forms the most practical mode for the drill, although quite a number of other good arrangements were observed. The mode of raising and lowering the rope and tackle is by using a wood or pipe derrick. The drum is at the base of the derrick and the hoisting rope runs up over a tackle block at the top. From this point the rope runs down to the boring devices. By this means the boring outfit can be raised and lowered at will. The free fall, or the jar system, is effected by the use of steam power, or air power, or, as is more usually the case, by having a regular patterned, free-falling, trip instrument. The latter consists of a cylinder containing clutches in which said clutches are released to allow the cutting tool to drop with cutting blade down upon the bottom of the bore. Then the clutches mechanically interlock again as the instrument closes in so as to make ready for another stroke.

I saw numerous types of derricks, most of them constructed of wood. The patterns I noticed made of piping seemed to be very effective. In Fig. 12 is shown a pipe-made derrick. All of the piping is ordinary,



Cutting Tools and Pipe Derrick.

3-inch tubing, with threads cut so as to form unions in heavy 4-sided unions as shown.

The base ends of the pipes fit into posts *G*, *G*, *G*, *G*, which are set firmly into the ground. One would be surprised to note the vast amount of piping employed for oil service at the wells. Piles of casing are everywhere, and much of it is never used owing to its being the wrong diameter. Besides piping for cases, tubes and the like, considerable piping is needed at all petroleum oil wells for carrying oils to different points.

Spouting wells are often suddenly developed and pipes are wanted to care for the oil. Much oil is often lost because of lack of pipes in stock. Pipes are required with which to make pipe lines for transporting oil to commercial centers, to storage tanks near railroad lines and to places for keeping near the wells. The development of the oil working industry in America has given quite an impetus to the pipe and pipe fitting trade.

Mechanical Conveying of Coal and Coke in Gas Works.[1]

[A paper read by M. Henri Laurain at the last meeting of the Society of French Gas Engineers.]

The De Brouwer conveyors have already been described before the members of the Société Technique; and at the International Congress of last year, we were able to see, by the various descriptions given of works, how the use of such plant abroad has extended rapidly. In France, gas managers have been a little more cautious, though it seems that lately a very distinct tendency has shown itself towards the adoption of conveyors for all new installations which are being put up. It is to be anticipated that this tendency will also lead gas engineers to apply them to existing plant. Notwithstanding the hesitation to which I have just referred, the Continental Company for the manufacture of gas meters and other apparatus, who are the sole agents in France for the De Brouwer patents, have in particular been able to put up a certain number of plants, among which are some very important ones. Nearly all the members of the Société Technique have seen the installations at Fontainebleu and Saint-Quentin. Since then we have put up plant at Rheims, Albert (Somme), Rouen, Dijon, and Havre, and we are now just finishing one at Lyon-Vaise for MM. P. de Lachomette et Cie.

When M. de Brouwer designed his apparatus, he only had in view the quenching of the coke coming from the retorts, and its transportor conveyance outside the retort house. Afterwards, M. Rouget conceived the idea of applying the same conveyor, or that part of it forming the return chain, to bring the coal in front of each of the retorts in a bench to be charged; and at the Nice meeting he himself described to you the general arrangement of a double acting conveying plant. He has also had the idea of combining the De Brouwer apparatus with all the accessories required for breaking the material, sorting and placing it in store or in carts by mechanical means. Since the reading of the different papers to which I have just referred, certain crude arrangements have been modified, following reports made on the plants in daily work, and indisputable results have been obtained; and it is exactly these alterations and results which I wish to discuss to-day. I have just said that some of the results obtained were indisputable; and I trust to justify this expression by simply saying that it is precisely these results which, by being spread among French gas managers, have started the forward movement to which reference was made at the beginning.

No one now disputes either the utility or the advantages of adopting hot coke conveyors; and one is entitled to ask why they are not more used in France. I believe they are not sufficiently well known; and it is for this reason that I thought it might be useful to speak of them at some little length. For the sake of greater clearness, I will divide the investigation into two parts. In the first I will deal with the mechanical conveyance of the coal up to, and its deposit in, the retorts; in the second, with the mechanical conveying of the coke coming from the retorts up to and including the putting of it into sacks, carts, railway trucks or heaps—all, of course, after sorting.

First Part.—The Handling of Coal.

In this portion of the paper, I shall have to consider in succession the following subjects: (A) Heaping the coal in the stores. (B) Bringing the coal in front of the retort arches. (C) Charging the retorts.

A.—*Heaping the Coal.*—The problem of heaping coal in the stores has been put very clearly to us by one of our members, who had to deal with an amount corresponding to a yearly carbonization of 50,000 tons (metric), under the following conditions: The coal arrives at the point *T* (Fig. 1) by means of carts, which are filled at the port, and it is required to place it in a heap, 4 meters (13 feet 1½ inches) thick on the vertical line, in one of the 3 compartments of the coal store, arranged

1. Translated for the *Journal of Gas Lighting*.

as shown on the diagram. The problem was solved in the following way: At *A* is provided a chain of elevator buckets, which receive the coal brought to the hopper *a* by the carts, which are emptied at *T*. This elevator delivers the coal into the trough of a primary horizontal conveyor *B*, which divides the stores perpendicularly at their greatest length. In each of the 3 compartments of the store, there was placed an auxiliary conveyor *C*. All these conveyors can receive the coal carried by the transverse conveyor *B* through trap-doors made in suitably chosen places. It follows that if the elevator, the transverse conveyor, and one of the auxiliary conveyors are working together, by opening one of the traps made under this conveyor the coal deposited at *T* may be carried mechanically to any point whatever in the store. The work of placing coal in store will therefore be reduced to working some trap-doors by hand; and the heaping will be done much more quickly, owing to getting rid of the inevitable hindrance caused by carts being in the compartments of the coal store. The speed of unloading the boat will depend solely on the power of the elevator *A* and on the carriage by carts.

B.—*Bringing the Coal in Front of the Retort Arches.*—If we take the coal from the heap in the store, we have first of all to bring it to the hopper T^1 (Fig. 2) of an elevator, which is generally placed outside the retort house. When it is working with benches of back-to-back retorts, the elevator N^1 will have to feed both sides of the same bench. For this reason the elevator is placed on the center line of the bench, and at its top part is provided, at *D*, with a hopper, with movable slope, which allows of guiding the coal supply into one of the two shoots *G*, which throws it on to the return chain of the De Brouwer conveyor, arranged along the façade to be worked. As the chain travels in the direciton of the arrows, it will be seen that the coal can be led along this façade to the desired point. For this it will be sufficient to provide a set of slide doors in the wide bottom of the upper trough, which will allow the coal to fall into the chambers of a tank *W*, which runs the whole length of the front of the bench at about the height of the hydraulic main. It is from this tank (which is, in fact, only an intermediate one) that the charging apparatus will be supplied with the necessary quantity of coal for the different retorts.

The existence of this intermediate hopper would not appear at first sight to be justifiable. But this is not so, because, in order to effect an economical and reasonable working of the conveyor chain, the latter should not be put in action specially for carrying coal; on the contrary, one must take advantage of its working during the time of the draw. To accomplish this, the two distinct operations of charging and drawing should not be absolutely and jointly combined, and, therefore, it is necessary to arrange for a certain give-and-take. This is precisely the duty which the intermediate tank fulfils. It will allow of regulating the sequence of the different operations of charging, so as to have in each case the minimum of labor, the minimum of fatigue for the staff, and also the minimum of time for the working of the chain. This last point is very important in order to effect economy in motive power, and in the maintenance charges of the plant. This intermediate hopper is also easily put into position, as it can be placed on the brackets which have to carry the guides for the return chain, and as the bottom of the upper trough will be formed by the top framing of the girder of the tank itself.

To bring the coal from the store to the hopper T^1, one can use, according to circumstances, either tip wagons or a conveyor, such as has been described for heaping the coal. Local circumstances will decide the choice to be made in each particular case.

C.—*Charging Apparatus.*—These machines are of three different weights—one to serve each tier of retorts on the same level on either side of the arch. Apart from this question of the length of the cylindrical portion, the 3 machines are the same, and it will be sufficient to describe only one of them. Each charging apparatus is made up of a cylindrical hopper *C* (Fig. 3), the upper part of which is fastened to a portion which is slightly widened out to form a funnel. This hopper is supported by a little carriage *S*, with 4 rollers *G*, which run on a track hung from the intermediate tank. A chain *Z* comes down to the height of the workman's hand, and enables him to bring the hopper under the door of the intermediate tank, which supplies it with coal. The lower part of the hopper is cone shaped, continuous with which is the shutting-off gear; and under this is placed a support on rollers for the purpose of carrying the ordinary scoop, as used at present in a large number of gas works. The opening and closing mechanism above the scoop is most simple, and is automatically worked by the scoop itself. Two cleats have been placed on the side of the scoop—one in the front on the left, and the other at the back on the right. The first acts in passing on the opening lever, and the second on the closing lever, when the scoop is charged.

The apparatus is worked by 2 men, or by only 1 man. In the former case, the front part of the scoop is placed on the supporting roller underneath the hopper, the other end, having the handle, being held by a workman, or better by the carrying strap fastened by a chain to a little carriage running on rails parallel to the bench. To work the apparatus, one of the men, whom we will call A, stands by the side of the chain actuating the hopper, while the other, B, who is the actual stoker, stands at the end of the scoop holding the handle. A will bring the apparatus in front of the retort to be charged, while B will also move along sideways with it; and as soon as the machine is in front of the retort, pushing the scoop into the inside of the retort. The left cleat will come in contact with the closing arrangement, and open it, and the coal will flow into, and spread over, the scoop (the theory of the natural angle of repose not entering into consideration) up to the moment when the right cleat will act upon the closing lever, just as the scoop is full. The stoker will then only have to make a last effort to push the scoop to the bottom, turn it over, and pull it back. He will begin again for the second half of the operation of charging the same retort. The charge will therefore be made with 2 scoop loads, each having half-a-charge. When the man B returns after the second time, A will work the chain so as to move the hopper, and free the mouthpiece of the retort charged; he will then shut the lid, and be ready to pass on to the next retort. If before leaving the chain he has brought the hopper in front of a retort ready to be charged, and if the hopper contains enough coal for a second retort, B will be able to charge it, while A is shutting his lid. If, on the other hand, the hopper is empty, he will have to place it underneath a filling door, so that the operation of filling may be done during the time the lid is being shut.

When one man is employed, the machine is only intended for small works, in which the night staff is reduced to but one stoker. He will begin by drawing his retorts, and then fill the apparatus corresponding to the height of the tier on which he is working. By means of the chain, he will bring the hopper in front of the retort to be charged, and will then place himself at the scoop handle. He will work as already described for the charging of the retort, return to the chain, move the hopper along, close the retort lid, and pass on to the next one. We believe we have thus solved the problem of charging retorts by scoop with only 1 man. It is obvious that his work is much reduced, as he will

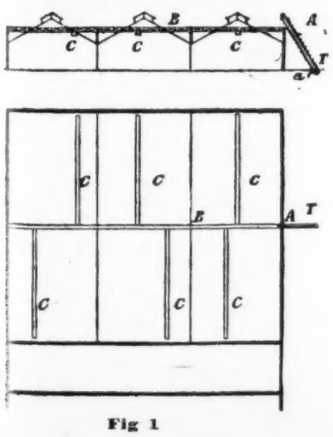


Fig 1

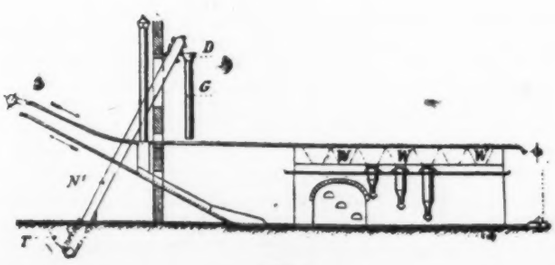


Fig. 2.

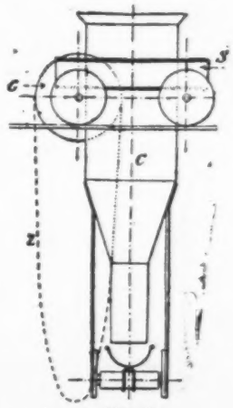


Fig. 3.

not have to trouble himself about the coke which will be quenched and carried away by the conveyor.

Second Part.—The Mechanical Conveyance of Coke.

We have carried out the whole programme of conveying the coke from the retorts to carts or heaps in the installation which we put up, at the end of the past year, at the Dijon works of the Compagnie Gaz et Eaux. It was there required to convey the coke resulting from the carbonization of 25,000 tons (metric) of coal per annum. The plant was applied to the whole of the arches arranged back to back in 2 benches—1 including 10 arches and the other 8 arches. These 2 benches were arranged in a line, one after the other, as shown in Fig. 4. The mechanical part of the installation includes four hot-coke

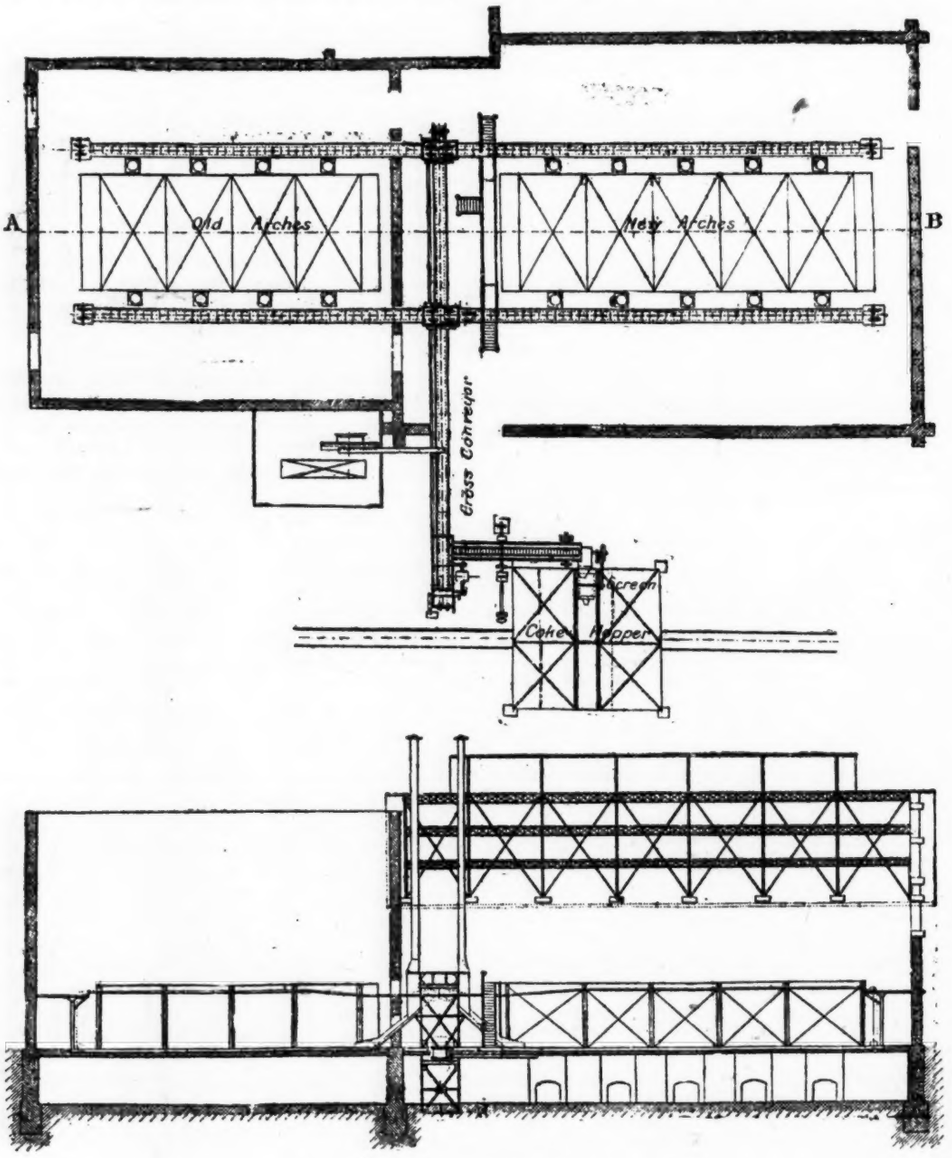


Fig. 4.—Coke Plant at the Dijon Gas Works.

conveyors, each serving one range of arches, all four throwing their quenched coke into collecting elevator, placed transversly between the two benches. Each conveyor has a quencher, increasing the duration of extinguishing; each quencher being provided with a chimney for carrying above the roof the steam produced by quenching. The coke lifted by the conveying elevator falls, first of all, on to a double shaking-screen. The first passing of the coke over this screen is intended to remove the moist dust, which, if kept in contact with the coke, would find its way into the many small holes of the large pieces. When these become rather dry, the dust is released, and thus the sorted coke is made dirty by it. After this elimination of the wet dust, the coke is made to pass over the second part of the screen, which has a bottom made of perforated sheet, with holes of a diameter which only allows the passage of the pieces that are already of a size to be classified. In all our work, we have acted on the principle of only carrying to the breaker the coke which needs breaking, affecting *en route* what we call the "first sorting."

The coke which has passed through the screen, and that which comes from the breaker, is brought together in the same hopper supplying an elevator, which lifts and throws the coke on to a Cox screen, with shuttle-sieves added. The screen itself is placed above the coke tank, so that the different classes of sorted coke fall directly by gravity into its compartments. We also use cylindrical screens, if they are preferred by our clients. We are not infatuated by any type either of coke-breaker or of screen, as we use all kinds. The drawing clearly shows the shape of the coke tank; and it is easy to see that it is only necessary to open one of the doors to discharge in bulk, into a cart below, the coke contained in one or other of the compartments. If circumstances require it, the cart can easily be replaced by a railway truck or tip-wagon, etc.

For putting the coke into sacks, on both sides of the tank there are slide openings, either with or without hectoliter measurers. The different sliding doors already referred to have been carefully studied, as it was, in fact, difficult to close them easily, so as to cut off the fall of coke sharply and cleanly. We have, however, arrived at a simple solution, which gives full satisfaction. The question of filling the elevator buckets has also been fully considered, and the form of the feeding hopper has given every satisfaction at Dijon. The double-shuttle screen can also advantageously be replaced by a small cylinder with 2

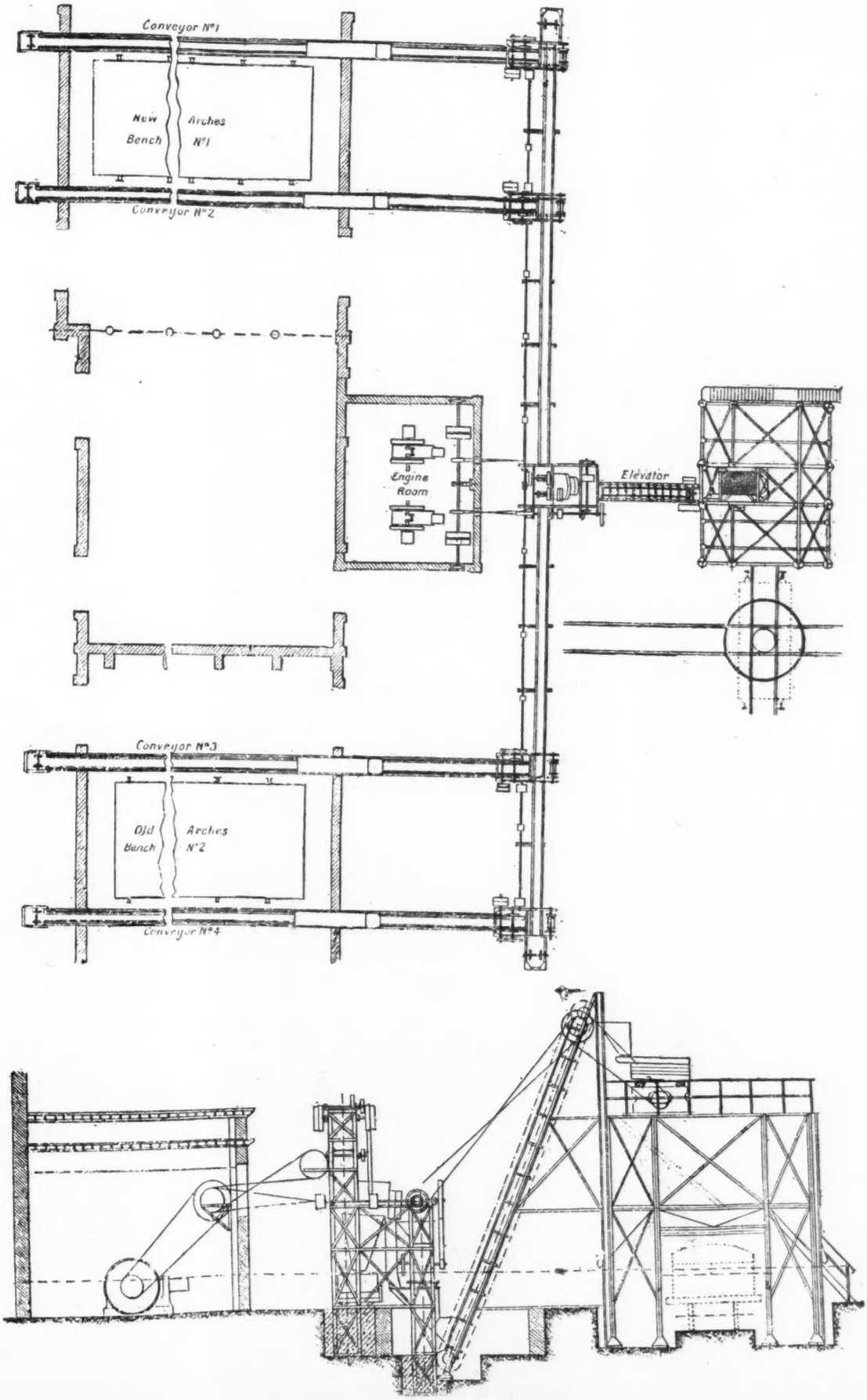


Fig. 5.—Coke Conveyors at the Havre Gas Works.

rings. Its adoption avoids the vibrations and shocks caused by the cams working the shuttles.

The general arrangement of the plant at the Havre Gas Works, which is for the conveyance of coke from the carbonization of 45,000 metric tons of coal a year, is shown in Fig. 5. As will be seen, there are 4 hot-coke conveyors, all ending in a common conveyor, which takes the coke either to the heap or to the breaking and sorting shed—the latter being similar to that at Dijon. The coke tank contains 1,500 hectoliters.

I have spoken of 2 very important installations; but it must not be forgotten that the processes just described are applicable to small and average works, with as many advantages. In this connection, the example of the works at Albert (Somme) is altogether conclusive. These works carbonize about 2,500 metric tons of coal per annum—that is to say, one-tenth of the quantity carbonized at Dijon. The plant includes a single hot-coke conveyor working a bench of 3 arches in line. The coke falls into the hopper of a small coke crusher, and an elevator lifts the broken coke to a cylindrical screen, which separates it into its divisions. The coke is also put into sacks automatically. My colleague, M. Deschamps, was bold enough to recognize at the outset what services could be rendered by mechanical appliances. He did not await the results of large installations, as his plant has been working since 1898. From that time, he has stated that, among other things, he has effected a yearly economy in labor of 1,800 frs. ($360). We shall see by the figures which follow that this saving is very nearly proportionate to that realized by bigger plants.

At Dijon, thanks to the kindness of the Directors of the Compagnie Gaz et Eaux, it has been possible to follow closely the working of the plant; and I am pleased to give the average results of a great number of tests. It is somewhat difficult to compare the different aspects of the coke service from the retorts to its leaving the works, as it is carried on by hand (as is generally done), and as it is effected by mechanical means. The operations are not, indeed, the same in the two cases. Nevertheless, I shall try to make some restricted comparisons, and will conclude with a general one. The latter is the most correct and the most interesting.

In the first case, the quenched coke is in the barrow; in the second, it is also quenched, but it is elevated and ready to be thrown into the hopper of the coke-breaker, without additional labor.

Quenching and Conveying Outside.

	Without Mechanical Conveying.		With Mechanical Conveying.
Average duration of the charge from the opening of the first lid up to and including the quenching of the last barrow of coke taken away, in minutesmen by retorts	14.9	..	8.2

Difference in favor of mechanical appliances—

$$\frac{6.7}{14.9} \times 100 = 41 \text{ per cent.}$$

Breaking and Sorting.—In the first case, it is necessary to take the coke in the barrow and carry it to the breaker, then empty it into the hopper, and afterwards put it into sacks or into heaps. In the second case all this work is done at once.

In 300 working days per year there were employed per day—

	Without Mechanical Conveying.		With Mechanical Conveying.
Men	14	..	2
Horses	2	..	0

Difference in favor of mechanical appliances—12 men and 2 horses.

The only men required by the mechanical plant are 2 mechanics (one for the day and the other for the night) for attending to the driving-engine and for the regular maintenance of all the apparatus.

To sum up, and without going into the details of the wages paid to the different classes of men dispensed with, it may be stated that the reduction in the staff, owing to the adoption of conveyors, elevators, breakers, and screens, has been 20 men and 2 horses during 300 working days. The men on 365 actual working days have been reduced proportionately to men at 300 days. Applying the rate of wages in force at Dijon, we have—

$$\left.\begin{array}{l} 20 \times 300 = 6{,}000 \text{ men-days} \\ 2 \times 300 = 600 \text{ horse-days} \end{array}\right\} = 25{,}800 \text{ frs. ($5,160).}$$

This amount will be still higher when the plant is fully employed, because at present only 18,000 metric tons are carbonized, instead of eventually 25,000 tons. If we reckon 2,800 frs. ($560) per annum as the cost of supplying renewal pieces, oiling, etc., we shall have a net yearly saving of 23,000 frs. ($4,600); and consequently, when we say that plant, such as has just been described, ensures an economy of 75 c. to 1 fr. (say, 15 cents to 20 cents) per ton of coal carbonized, we are under the real figures. Also, as we foresaw in speaking before of the plant at the Albert works, the figures given by M. Deschamps for these little works are entirely confirmed by the results obtained in works nearly 10 times larger. It must be admitted that between these two extremes the results will be practically the same; moreover, we shall have an opportunity before long of verifying what, in installations in prospect, has been stated.

In conclusion, I may sum up by saying that I wished to show very briefly what we have been able to do towards improving the various mechanical appliances of which descriptions have been given in preceding papers. You were able to see, at the last congress, that such plant is much adopted abroad. You have learnt that those who use it in France have not been deceived in their hopes. As was stated at the beginning, apart from the now indisputable question of economy, the general situation gives these mechanical appliances a degree of importance that will not be overlooked by any of you.

Ingrey's Automatic Coal Weighing and Recording Machine.

The modern practice of storing coal in bunkers at a high level, and allowing the supply to fall by gravitation to the boiler furnaces beneath, affords a good opportunity of applying means to weigh the fuel and obtain a record of the consumption of each boiler. It being understood that the mere measuring of coal is not a true indication of weight, and that in any case it is essential to dispense with manual labor and written records, it is evident that, to be effective, an apparatus should absolutely weigh each load, record the weight, add it to the total, and be entirely free from individual interference. The illustration shows an apparatus devised by Mr. Charles Ingrey, of 28 Victoria street, Westminster, London, England, which fulfils these conditions satisfactorily.

The coal is contained in bunkers above, having hopper openings agreeing with the center of the boiler furnaces. Beneath each opening is placed a partially cylindrical receiver which is pivoted in the center, and has an opening at the top and the bottom. This cylinder is capable of being moved upon its pivot to a degree sufficient to close the hopper, whereupon the opening at the bottom of the cylinder is exposed, and causes the contents to be shot into a weigh bucket beneath.

The operation of the apparatus is as follows:

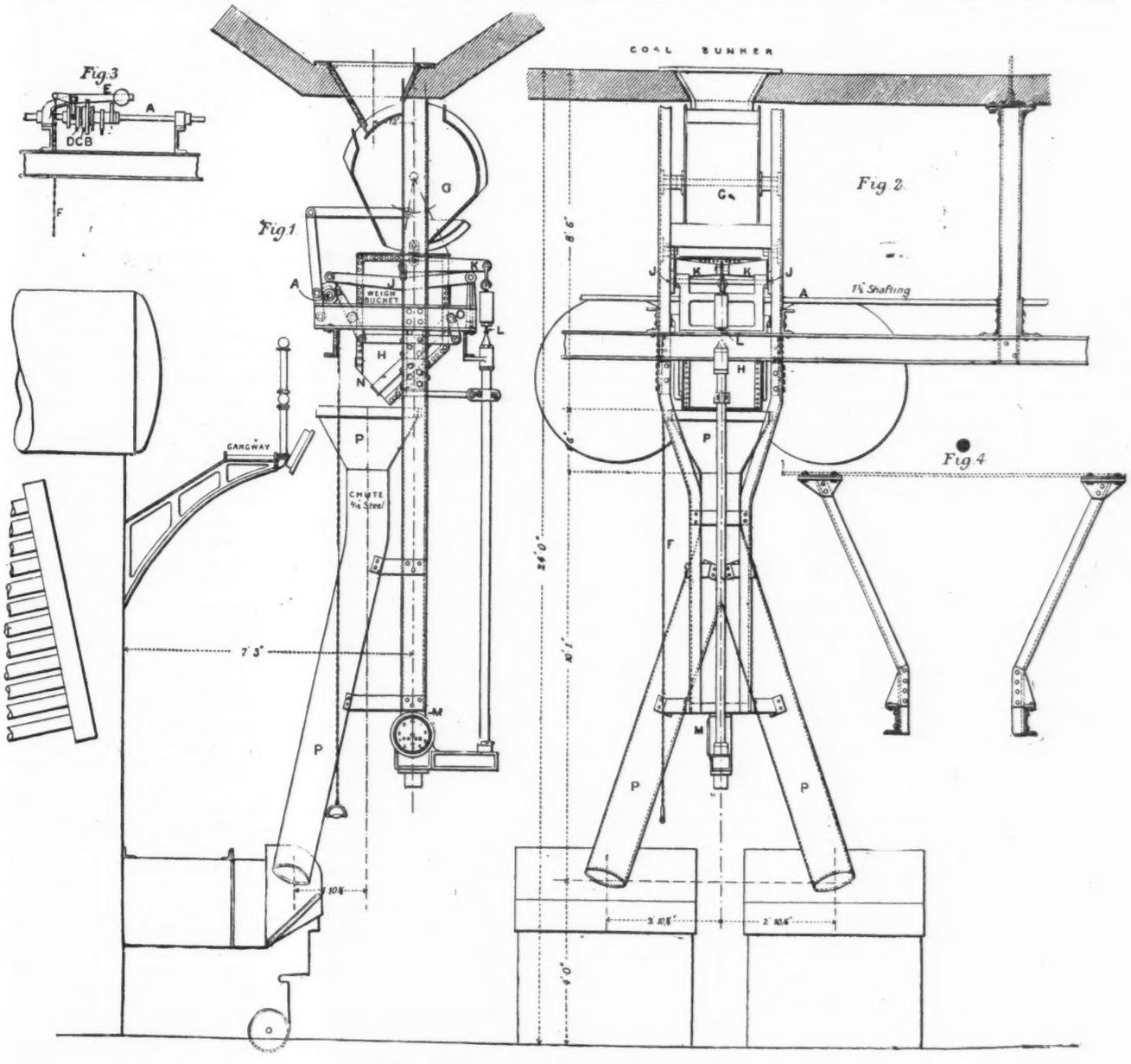
Along the length of the boiler house is a slowly revolving shaft, turning, say, once per minute. Upon the shaft are mounted (in connection with each machine) three cams, which normally are loose, and are retained in position by a loose collar. The end of a sleeve carrying these cams is provided with half a clutch; another half clutch runs upon a feather key on the shaft, and is capable of being operated by a weighted lever *E* (Fig. 3).

When the lever is worked by the pulling of a cord or rod *F*, the clutch engages and raises the lever out of a slot formed in a disk attached to the cams, which latter now revolve with the shaft until the slot again presents itself, whereupon the lever falls into it, and the cams are thrown out of gear after making one complete revolution.

The first action of cam No. 1 is to move the pivoted cylinder over to the position shown in Fig. 1, and to deliver the coal to the weigh bucket, the second to restore the cylinder *G* to its normal position, where it is filled again ready for the next operation. Cam No. 2 then causes the ends of two supporting girders to descend and to gently lower the weigh bucket on to the knife edges of a weigh beam, and to transmit the absolute weight to the recorder through the medium of a weigh rod which is enshrouded in a tube. The supporting girders are then returned to their upward position and lift the bucket clear of the knife edges. Cam No. 3 now comes into operation, and by means of a lever and connecting rod opens the hinged door and allows the weighed coal to flow down the chute *P* to the boiler furnaces.

The door is retained open for a short period to insure complete delivery, and then descends by its own weight, and closes the spring at the bottom of the weigh bucket. The last operation is (by means of a rod not shown in the elevation) to release the pointer of the recorder *M*, which then returns to zero, and simultaneously moves the dials of the integrator, which precisely registers the weight, and adds it to the previous total. The cams having completed the one revolution, they are thrown out of gear, and the machine is ready for subsequent use.

It will be seen that the whole operation is perfectly automatic, all that is necessary on the part of the boiler attendant being to pull the



Ingrey's Automatic Coal Weighing and Recording Machine.

handle on the cord when he sees that the stoker hopper requires replenishing.

It is, of course, generally known that with mechanical stoking, considerable waste of fuel can take place if the rate of feed is not attended to. By means of this apparatus the engineer can see at a glance what coal has been consumed, and ascertain whether the boiler or the attendant is doing proper duty.

By means of a pivoted or a breeches shoot *PP* each machine can be made to serve 2 furnaces; but to meet circumstances in which it is not considered desirable to employ a machine for each boiler. Mr. Ingrey has devised a movable machine running upon rails over head. In this the revolving shaft is dispensed with, and the necessary motion transmitted by a wire rope or chain, which can also be used to traverse the machine when desired.

The load is approximately 5 cwt., which is about the capacity of a stoker hopper.

It should be mentioned that the recorder is hermetically sealed. The only place where dust could enter would be at the mouth of the tube containing the weigh rod, but this is protected by an oiled silk diaphragm which acts as a dust excluder and does not offer any resistance to the weigh rod. It is also to be noticed that the operation of recording the weight takes place after the delivery of the coal and the closing of the door, so that the jarring of the latter does not affect it. The recorder reads to 99.99 tons, or could be made for a greater total if desired. The essential feature of the Ingrey system is the automatic weighing of varying loads in contradistinction to that of accumulating and measuring a predetermined one.

Address of the Chairman (Mr. George Livesey) of the Gas Section of the International Engineering Congress, held in Glasgow, Scotland, Sept. 3, 4 and 5.

We may parody the proverb, "There is nothing like leather," and say, after its 100 years of life, that there is nothing like gas. Its convenience and adaptability to a multiplicity of uses, the beauty of its light and its cheapness, account for its sustained popularity and render it indispensable to modern life. It has played a great part in the industrial progress and the civilization of the wonderful 19th Century; and it is a safe prophecy to declare that it has at least as great a part to play in the 20th. A hundred years ago Murdoch introduced coal gas as an illuminant in the factory of Boulton & Watt at Birmingham; and a few years later the first gas company was established to light London. From that time the growth of the industry has been both continuous and rapid, and never more so than in the last decade. The price has been reduced to about one-fifth of that charged 70 or 80 years

ago; and it would not be very wide of the mark to say that gas is used in almost every house and workshop in our cities and towns.

The great reductions in price need more than a passing notice; for in this particular the reduction in the charge for gas stands out in striking contrast to the charges for the 2 sister public services that, with gas, have been so largely developed by joint stock enterprise—viz., water and railways. From the early days of gas there has been, and is still, a general desire to reduce the price. Possibly one reason may be found in the fact that, in almost every place of importance, rival gas companies competed with each other for custom during the first half of the century. There is, however, another reason. Here and there throughout the country were men (and happily the race is not extinct) in charge of gas works, not content to leave well alone, or to stand still, but always striving to improve; thus setting the pace which had to be followed more or less closely—in fact, very closely in the competing days. Competition, however, killed itself. The last effort in that direction was the formation of the Great Central Gas Company to supply the city of London, and the Surrey Consumers Company for South London, whereby the price of gas was temporarily reduced from $1.50 to $1 per 1,000 cubic feet in 1850. So severe was the competition that the old and new companies soon came to the conclusion that it was suicidal, and allotted a separate district to each company—thus creating a monopoly in the supply of gas in London. The same thing was done in the large towns, where the competing companies united; hence so many "United Gas Companies." In the year 1860, Parliament, being convinced that competition in gas had become impracticable, and the existence of the mains of several companies in the same streets a grave public inconvenience, sanctioned the districting of the whole Metropolis; and henceforth competition between gas companies ceased everywhere.

Then came a period of great prosperity—if the payment of full dividends and the making up of back dividends alone deserves the name. The existence of pioneer men, of the class already referred to, saved the industry from disaster. Gas had no competitor; for candles, and oil at from $1.25 to $1.75 per gallon, could not be so regarded. There was, therefore, no inducement to improve, but rather to sit still, take the new business that came of itself, and pocket the profit. Gas companies' capitals increased, as well they might when new issues were allotted to the shareholders at par, on which full dividends were practically guaranteed. To protect the consumers, Parliament was led, in 1860, to introduce the system of testing the illuminating power and purity of the gas—legislation that has never done an atom of good, but an infinity of harm, to the public, and it has culminated in the elaborate and costly and worrying system in vogue in the Metropolis.

From the early days of gas lighting up to the end of the century, the public, and gas makers also, have believed that gas of as high an illuminating power as possible was the *desideratum*. Companies were established in London for the supply of cannel gas in competition with others making gas from Newcastle coal. One of them, the South Metropolitan—started with this object in 1833—was only saved from bankruptcy by changing to common gas in 1838. Everyone, in fact, was on the wrong tack. Instead of trying to develop the lighting power of the gas, which I think Mr. Sugg was one of the first to attempt, the idea was to make it as rich as possible in hydrocarbons. Then, perhaps to prevent the inconvenience and dirt of smoky flames, burners were used that certainly accomplised that object, but they gave very little light—in some cases about 1 candle per cubic foot of gas. Sugg's "London" argand, Bray's flat-flame burners, Siemens, the Wenham, and others of the regenerative class, were all important steps in increasing the duty per cubic foot, until Welsbach's wonderful invention capped, and seems destined to supersede, them all by the introduction of an entirely novel and really scientific method of obtaining light from gas. The consumers now have it in their power to get out of 5 cubic feet of gas per hour anything from 5 to 150 candles from ordinary coal gas, whether it be nominally 10, 15, or 20 so-called candle power.

What a useless absurdity does this make of all the illuminating power tests! Photometers that for 40 years have given so much trouble, caused so much anxiety to, and wasted so much of the time of, gas managers, and have also caused so much loss to the consumers, are now proved to be, what they always have been, most useless instruments, and must sooner or later have their woodwork converted into firewood, and their metal consigned to the old brass tub—to trouble gas managers no more.

Reverting to the historical summary, the period of fictitious prosperity, with nothing in the shape of competition, lasted about 10 years—to the early seventies. Then appeared the first serious competitor in the shape of cheap mineral oil; and a few years later the electric light entered the field. Gas lighting was thus attacked on both flanks—in its rich and poor, upper and lower consumers—with serious danger of attacks on the center. Gas had no longer a monopoly as a light giving agent; but Parliament, at the instigation of local authorities, instead of relaxing restrictions, increased them. When the supposed necessity for protecting the consumers had ceased—for they could be independent of gas—more stringent regulations were imposed. In all probability this was a result of the 10 years' absolute monopoly, when regulations of some kind were necessary. It was not perceived that, with entirely altered conditions—the change from monopoly to active competition—relaxation and not increased restriction was what justice to the gas industry demanded and the service of the public required.

The old legislation, dating from 1847, governing the price of gas and the rate of dividend, was adapted to competing gas companies. When that competition ceased, which was the real protection of the public in the matter of price, the legislative enactments had no effect on the price, while they gave ample protection to the shareholders' dividends. In fact, it separated rather than drew together consumers and shareholders. This was remedied by the sliding scale introduced in gas legislatfon in 1875; its sole merit being that it identifies the interests of consumers and shareholders, and in effect makes them partners. Whether or not it is the best means for accomplishing that object may be questioned; but our goal is complete identification of the interests of producer and consumer. Until a better plan for its attainment is devised, the sliding scale holds the field; and I venture to say it should have been made compulsory, just as are the auction clauses, of which it forms the complement. At any rate, the principle is right, and it is only a question of improving the method of its application. The sliding scale, as embodied in gas legislation, supposing it to be the best known means of accomplishing the object in view, at present stops half way. There is another to be included in the partnership—another interest to be identified. The producer is not one but two the man who finds the capital and the man who does the work. I have tried to make a triple partnership—capitalist, employee and customer; and the results of 12 years' working have greatly exceeded expectations. If, 10 years ago, anyone had said that the employees in 1901 would have $700,000 invested in the stock of, or on deposit at interest with, the South Metropolitan Company, I should have pitied his ignorance of working men; for of such a result I never dreamed.

The result of 7 years' working of the same system in the Crystal Palace District Gas Company is equally satisfactory. In a sense, better even than the money earned and saved by the men, is the feeling of mutual confidence and goodwill that exists between all ranks in both Companies. The workmen of another large company have, with practical unanimity, just accepted the system, as the men at Chester did a few months ago: and profit sharing without shareholding was, about 2 years ago, adopted at the Corporation gas works at Stafford.

Here companies have the advantage over corporations, and to the inestimable service gas companies have rendered to the public during the last century may be added (if they will) the further great service to their country of showing how the interests of capital and labor, of employer and employed, may be reconciled. The system has had much thought spent upon it, and, no doubt, may be improved; but if from a first attempt such results have been obtained, what may not be expected if other minds will bring effort and intelligence to its working and improvement. The object is well worth all the labor spent upon it, and it brings an ample reward.

Since gas ceased to hold the monopoly of light, nearly 30 years ago, the advance and improvement in its manufacture and supply, and its increased uses, have been greater than ever, more especially during the last decade. The South Metropolitan Company used 637,583 tons of coal in 1890, and 1,130,833 tons in 1900—an increase of 493,250 tons in 10 years, or 77 per cent.; that is, the actual new business gained in the last 10 years is not very far short of the total acquired in all the previous 71 since the first South London Company was formed. Gas not only more than holds its own as an illuminant, but since its monopoly as an artificial light ceased, it has come very largely into use for cooking—although a few gas cooking stoves were in use over 50 years ago—heating, power and manufacturing purposes. By means of the slot meter it has taken almost universal possession of workmen's dwellings; and by the Welsbach mantle it has distanced all competitors in the beauty and cheapness of its light. We hear of decaying industries; but with such vigorous growth, instead of decay, there is abundant life, that gives promise of more uses and greater usefulness than ever.

This is an Engineering Congress; but the subject has not been mentioned in this address. In attempting to speak for this great and indispensable industry, surely the fact that it has been created, built up and

sustained by engineers is sufficient. Its future rests with engineers more even than its past has done; and those who devote themselves to it will find ample scope for their talents, however varied they may be. The first and greatest need of the gas industry is that the supply of men should be maintained. Men in the best sense of the word are needed, in all ranks, to fill up vacancies and to occupy new ground. Board and technical schools do not produce the article; I sometimes think they rather tend to check the development of manhood. Technical training will not save the national industry; but men who love work more than play, and who will put heart and brain into their work, are the necessity of the age. Technical training is very good and necessary, but you must first "catch your hare," or rather find your engineer, before you train him; and then take care that you do not convert him into a man of mere routine—a simple copyist. The making of plans and sections, and the calculation of strains, are not his highest work. It is not by the repetition of old designs and ideas that progress is made. We need engineers who will look ahead, anticipate, as far as possible, public requirements, and then bring all their skill to meet them. One of the greatest of public necessaries is smokeless towns and cities. The gas engineer is the man to provide smokeless fuel, cheap, abundant and suitable for all purposes.

As is the engineer, so should be his helpers and subordinates, if he is to do the best work. One of his most important qualifications is the ability to select and train his assistants of all grades, down to the workman, who is very much what his employer makes him. This duty of employers, who are the natural and proper leaders of their workmen, and should be their trusted friends, has been too much neglected; and both classes suffer from the neglect.

The gas industry wants freedom to do its best for both the public and itself. Legislative restrictions should be removed and the suppliers of gas left free to do their best to meet the needs of their customers. The sliding scale and the auction clauses automatically insure the careful raising of capital at the lowest possible rate, and its judicious spending. They also make it the interest of the company to sell at the lowest possible price. The consumers can now take care of themselves; and the gas company, to be successful, must supply what its customers require at a price, and of a quality, that will satisfy them. I, therefore, ask that all needless restrictions—and most of them are needless, as is proved by the fact that in the case of corporation gas supply they are very much a dead letter—be removed, and that the gas industry generally be freed to meet the competition that confronts it.

The great public need is cheap gas of good heating power, the nominal illuminating power not being a consideration. We are much behind places on the Continent in this important advance; and we shall do well to follow their example. The great and immediate work of gas engineers is to meet this public want. In 6 years at most, the Welsbach patent of 1893 expires; and it may be proved to be invalid any day. With mantles at 5 cents each—the price at which they are now being obtained from Germany—only heating gas will be required; for incandescent lighting must then become universal. Therefore, let the engineer "take time by the forelock," forecast the future, and devise a satisfactory method of producing the gas that the near future (and it may be very near) requires. It is not so easy to bring down the illuminating power as would naturally be supposed; manufacturing plant has to be altered and new methods invented. Truly the engineer has a work worthy of all his efforts; the men surely will not be wanting.

A last word referring to the relations of public authorities with gas companies. Why are they so unsatisfactory? What other public service can show such a record of good work done for the public? What other article of utility has come down from $2.50 to 50 cents—the same article, and not something different? The public does not know the extent and value of the service. Glasgow has great and well deserved respect and esteem for William Foulis; but it does not know the extent of the benefit he has conferred on its citizens. In annual money saving alone, it is safe to say that the result of his personal labors, over that which would have been attained by an ordinary man, is gas at quite 6 cents per 1,000 cubic feet lower. Now, 2 cents per 1,000 cubic feet amounts, in round figures, to $100,000 a year; therefore, the gas consumers of Glasgow are indebted to their gas engineer for a saving of $300,000 per annum. When such possibilities rest with the gas engineer, it is surely but necessary to mention the fact to insure to the capable engineer the consideration and the treatment he deserves.

This is an International Congress, and we are favored with some very valuable papers both from America and the Continent. It is my misfortune that I know so little, personally, of gas manufacture abroad; but I do know that, in enterprise, invention and progress generally, they are certainly not behind us, and in many points we have much to learn from them. We hail them as brethren in the useful work of gas manufacture and supply.

Notes on Electric Transmission of Power from Niagara Falls.

Engineering Record notes that one of the most interesting papers presented before the American Institute of Electrical Engineers at its recent convention at Buffalo is that of Mr. Lewis B. Stillwell on the electric transmission of power from Niagara Falls. In its entirety it is a well-sustained thesis that, as the author puts it, progress in alternating-current methods since 1893, the date when the original contract for electrical machinery for the Niagara Falls Power Company was closed, has been in no sense revolutionary and that the time has long since passed when capital might reasonably hesitate to embark in well-considered enterprises depending for success on a correct application of electrical engineering skill. It is a significant fact, he said, that the electrical machinery to be installed in the second power-house now under construction will differ from that now in the first power-house only in relatively unimportant details of construction, while nearly every constituent part of the hydraulic equipment of the new plant will be materially and even radically different from its predecessor. In short, the paper may be styled a refutation of the common statement, "Electricity is in its infancy."

The paper takes up the engineering history of the plant under the following heads in order: the problem presented, system adopted, the first 3 alternators as planned and constructed, and under test and in service, alternators Nos. 4 to 10, the exciters, switching apparatus and measuring instruments, transmission and distribution, electrical equipment of the terminal house and the equipment of Power House No. 2. While it will be out of the question to take up even in brief the interesting conditions and solutions of problems leading to the final design and installation, the general features of which are doubtless more or less familiar to the readers of this article, there are a number of statements of the author and descriptions of details which it was desired to abstract or reprint, as the case may be, in this connection.

The system chosen to meet the complex requirements, unprecedented up to that time, was the alternating current system, using 2-phase alternators wound for 25 cycles per second and 2,200 volts. The adoption of the system was made, notwithstanding much advice in favor of the use of direct current. The author thought the rejection of the 3-phase system a mistake from present knowledge, but even with Scott's subsequent invention of the method of securing 3-phase currents from a 2-phase source, he believed that were the Niagara problem presented at the present time, he would incline to the use of 2-phase alternators which provide for 3-phase long distance transmission and single or 2-phase circuits for local distribution, with its accompanying convenience in load balancing. He considered the frequency was wisely chosen; that it was more generally used in America for electrical distribution for power purposes than any other. A frequency of 30 cycles per second he thought preferable, because 110-volt lamps of 16-candle power or more supplied at that frequency are free from any suspicion of fluctuation in candle power due to reversal of current, while at 25 cycles such is not the case, unless the conditions are assisted, as at Niagara, by a comparatively flat potential curve.

The method employed in balancing the revolving element of the alternators, which was devised by Mr. Albert Schmid, is described by Mr. Stillwell as follows: A special shaft is placed in the bearings of the machine, and supported at its lower end by a thrust bearing into which oil is pumped at a pressure of about 1,000 pounds per square inch. This pressure is sufficient to lift the weight of the revolving parts, and the collars on the shaft are separated from the grooves of the thrust bearing by a thin layer or film of oil. A small piece of tool steel is set into the upper end of the shaft, a half sphere or cup being cut in the upper surface of this tool steel, in which is placed a tempered steel ball ¾ inch in diameter. A large eye-bolt with a similar piece of tool steel, having in its lower surface a cup bearing similar to that at the top of the shaft, is secured in the taper bearing of the umbrella-shaped driver, to the periphery of which the field ring is bolted. The entire weight of the driver and the ring is thus supported upon the small steel ball. A casting secured to the shaft serves to rotate the driver and ring with the shaft. The steel ball is placed a very short distance above the center of gravity of the field and driver, and under these conditions, the driver and ring being free to rock while rotated, a defect in balance is quickly shown.

Another interesting point of the paper, though treating of generator design, may well be mentioned, and that is the damage to armature windings caused by short circuits. The magnetic force exerted momentarily by the enormous currents flowing through the armatures and external circuits when a failure of cable insulation resulted in a short-

circuit can be realized from the statement that lead-covered insulated conductors of 1,000,000 circular mils section, weighing upwards of 4 pounds per linear foot, have been thrown off from their supporting brackets to a distance of 5 or 6 feet. In one instance the cable was thrown a horizontal distance of approximately 5 feet while falling not more than 2½ feet. The difficulty has been overcome by inserting wooden spacing strips between the projecting ends of the armature bars.

With regard to the distribution of power in underground ducts, it was found that there was little information obtainable as to the relative temperature of different ducts in a conduit, and a test was made for the purpose, the result of which shows the importance of taking into account the dissipation of heat in cases where cables conveying large amounts of power are used. The power losses are 2-fold; those due to resistance of the copper conductors and those due to currents induced in the lead sheaths. For the test 24 ducts of 36-duct conduit were used, between 2 manholes 140 feet apart. No. 6 drawing wire was drawn through the ducts and these were connected at ends in such a way as to put 8 wires electrically in series, the 24 wires constituting 3 groups of 8 wires each. Current was passed through these in sufficient quantity to cause a loss of energy of 5.5 to 6 watts per linear foot. The test was continued for about 10 days and nights, with hourly readings. It was found that the rise of temperature of the air in the duct above the temperature of the earth surrounding the conduit was as much as 20° C., where the ducts are separated on all sides from the surrounding earth by at least one other duct, and that the rise of temperature in the case of ducts next to earth was about 60° C., or 108° F. If the temperature of the earth surrounding the conduit is assumed to rise in summer to 79° F., it follows that the temperature of the air in the inner duct may go as high as 114° F., while the temperature of the air in the outside ducts would be 188° under the same conditions.

To convey 15,000-horse power using 24 500,000-circular mil cables, the author calculated that if the temperature of the ground surrounding the conduit be 70° F., the temperature of the copper conductor will approximate 215°F. The practical result was that instead of local transmission to points exceeding 2 miles through the conduits at 2,200 volts, 3-conductor cables working at 10,000 volts supplied through step-up transformers were adopted.

Concerning the new long-distance power transmission pole line, the author, among other things, said that the length of span is doubled, that is, 140 feet as against 70 in the old line, and every third pole is guyed.

In the case of the old line it had been assumed that during sleet storms ice might cover the conductors to a radial depth of half an inch and the increased pressure would tend to assist the severe wind storms of that locality in overthrowing the line. It has been demonstrated, however, that ice never adheres to the power circuits while they are traversed by the working circuits, due in part, the uuthor presumed, to the heating effect of the current and in part perhaps to static repulsion.

It is certain, he said, that dry snow is statically repelled by the charged conductors. Experience has shown, he continued, that mechanically the weak point in the construction of the old line was the junction of pin and insulator, and the new pin at the top is 1½ inches in diameter against ¾ inch in the case of the old pin. From tests made to determine the horizontal stress which would break pin or insulator, or both, if exerted at the top of the insulator, it was found that a pin will break at the point where it enters the cross-arm under a pressure of about 2,100 pounds, which is about six times the calculated maximum pressure to which it will be subjected in service. The shoulder of the insulator, the test showed, will break under a horizontal stress of about 1,300 pounds in service.

Aluminum conductors are used for the line and where they pass near large chemical industries they are protected by a braided cover treated with asphaltum. The joints are spliced and wrapped, but not soldered. It has been found that when the wind is blowing at high velocity, the tightly strung copper conductors swing or vibrate irrgularly, but rapidly, and the vibration is transmitted to the pole, the trembling of which can be detected by placing the hand against it at a point near the ground. The aluminum conductors under similar circumstances tend to assume a fixed position, which is sometimes apparently as much as 45° from the vertical plane in which they hang when the air is quiet, and there is practically no vibration at the pole. The author thought the elimination of vibrating stresses on insulator and pin gratifying, as in the old line there was a tendency for the insulators to work loose, which he had no doubt was caused by the vibration of the conductors during heavy wind storms,

Utilizing the Sun's Energy.

Trof. Thurston discusses in *Cassier's Magazine*, for August, upon the problem of utilizing the sun's energy. He points out that in spite of the enormous deposits of coal remaining untouched in other sections of the globe, within a few generations at most, some other energy than that of combustion of fossil fuel must be relied upon to do the work of the civilized world.

He considers that water power, which is the next most important source of energy to coal, will do much for us, and quotes figures which go to show that the energy capable of use in the area drained by the Mississippi river, for instance, may be taken at about a quarter of a million horse power per square mile. In the next few lines, however, Prof. Thurston points out that such figures are of little value, and this is certainly correct. It is obvious that the available water power must be calculated from the minimum volume falling under easily utilizable heads. A fall of 6 inches per mile, as in the case of the Mississippi (with the exception of the 3 small water falls), is of no use whatever.

Prof. Thurston disposes of wind power and tidal power after very few remarks, and devotes himself principally to the consideration of the possibility of converting the heat of the sun into mechanical energy by some direct means.

He refers to John Ericcsson's contributions to the Centenary Exhibition in 1876, and the figures quoted are certainly interesting. It would appear that with Mr. Ericcsson's concentration apparatus, during 9 hours per day, an average of fully 3.5 units of heat per minute can be extracted for each square foot of area presented perpendicularly to the sun's rays in all latitudes between the equator and 45° of latitude. Theoretically, this works out to 8.2-horse power for an area of 100 feet. It appears that there is a rainless region extending from the northwest coast of Africa to Mongolia, 9,000 miles in length, and nearly 1,000 miles wide. Besides the North African deserts, this region includes the southern coast of the Mediterranean, east of the Gulf of Cabes, Upper Egypt, eastern and part of the western coast of the Red Sea, part of Syria, the eastern part of the countries watered by the Euphrates and Tigris, Eastern Arabia, the greater part of Persia, the extreme western part of China, and lastly, Mongolia.

In the Western Hemisphere, Lower California, the tableland of Mexico, Guatemala, and the west coast of South America, suffer from continuous intense radiant heat for a distance of more than 2,000 miles.

Calculations based upon the assumption that 1-horse power could be developed for every 100 square feet exposed to solar radiation would lead one to enormous figures if applied to the area above mentioned. For the purpose of example, however, Mr. Ericsson takes a strip of land a single mile in width, along the rainless western coast of America, the southern coast of the Mediterranean, both sides of the alluvial plane of the Nile in Upper Egypt, both sides of the Euphrates and Tigris for a distance of 400 miles above the Persian Gulf, and finally a strip also a mile wide along the rainless portions of the Red Sea above alluded to. The aggregate length of these strips of land, selected on account of their being accessible by water, far exceeds 8,000 miles. The area covered would be about 223,000,000,000 square feet, and on the assumption that 100 square feet could produce 1-horse power during an average of 9 hours per day, we are led to the conclusion that by suitable apparatus 22,300,000 engines each of 100-horse power could be kept working by utilizing only that heat which is now wasted on the assumed small fraction of similar land extending along some of the water fronts of the sunburnt regions of the earth.

These figures are certainly interesting, and it would appear from results of other experimenters that Mr. Ericcsson's assumption of 1-horse power from 100 square feet of receiving area is quite within the bounds of practical possibility. In fact, according to Prof Thurston, this figure has been confirmed by recent experiments at Passadena, in California, where it was stated that Ericcsson's efficiency has in some cases been attained. The apparatus used in California was a truncated conical mirror, 33 feet 6 inches in diameter at the top and 15 feet at the bottom, which concentrates the rays of the sun received upon its 1,788 facets at a focus, where a boiler is placed and steam generated to work a steam engine. The whole mass is moved by clockwork and automatically held with its axis directed toward the sun. The boiler, which is carried on the same frame and moves with the mirror, is 13 feet 6 inches in length and contains about 10 cubic feet of water and 8 cubic feet of steam space, pressure being maintained at 150 pounds per square inch. The apparatus is said to be of 10-horse power, but Prof. Thurston remarks that the reported figures are inconsistent with this rating. It is unfortunate that Prof. Thurston does not quote these figures, which would certainly be of great interest.

It is not often that nature makes things easy for us. As a rule, the really useful large water powers are also located in places remote from any form of civilization, thus severely handicapping the efforts of engineers to utilize the energy of falling water, and to turn it to useful account.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. H. M. PAPST, Engineer to the Equitable Gas Light Company, of San Francisco, Cal., writing to the JOURNAL, says:

To the Editors AMERICAN GAS LIGHT JOURNAL: On page 366 of the JOURNAL, dated the 2nd inst., I am charged with the following statement regarding proportional meters: "It stops if the pressure is too low, etc. I would strongly advise a small gas company to buy a proportional meter." The statement in the last sentence of the paragraph was made by Mr. L. P. Lowe. From my statements regarding proportional meters it would seem apparent that I could hardly advise the use of this machine for any gas company, large or small.

AT the annual meeting of the shareholders in the Woonsocket (R. I.) Gas Company the officers chosen were: Directors, Edwin Aldrich, Warren A. Cook, George M. Wells, D. D. Farnum, Chas. E. Ballou, G. A. Buffum, Chas. H. Darling, John W. Ellis and E. A. Mongeon; President, George A. Buffum; Treasurer, R. G. Randall.

THE Common Council of Washington, N. J., recently adopted a resolution to the effect that further consideration of the granting of a franchise for the operation of a gas works there, to Mr. William H. Burn and his associates, be indefinitely postponed. This likely means that the Washington franchise will eventually go to Mr. Addison Ely, of Rutherford, N. J., and his associates.

AT the annual meeting of the shareholders in the Standard Gas Company, of Matawan and Keyport, N. J., these officers were elected: President, A. P. Bachman; Treasurer and Manager, H. W. Davies; Secretary, Charles A. Gerau.

A CORRESPONDENT in Milwaukee, Wis., informs us that Messrs. Joseph Schneck, Lynn S. Pease and S. J. Pierce have filed articles incorporating the South Milwaukee Gas Company, with a capital of $50,000. The South Milwaukee Council has granted the Company a 50-year franchise. Its proprietors have not decided to build a separate works, and the indications are that, having established the necessary storage and distributing plant, the gas supply will be obtained from the works of the Milwaukee Company. Our correspondent adds there is little doubt that, whether a plant is built in South Milwaukee or not, the supply of gas thereto and therein will prove a profitable one for those concerned in it.

THE authorities of Duluth, Minn., have authorized Mr. L. N. Case, Manager of the City of Duluth Water and Light Department, to prepare for the extension of the gas and water mains to and through the adjoining district of Woodland, at an estimated cost of $26,500.

THE proprietors of the Willimantic (Conn.) Gas and Electric Light Company have appropriated the sum of $35,000 for the reconstruction of the gas division of their properties. It is proposed to construct a coal gas plant, and the scheme also includes the building of a storage holder of not less than 100,000 cubic feet capacity.

THE bondholders of the St. Cloud (Minn.) Gas and Electric Company, represented by Mr. A. F. Howard, of Portsmouth, N. H., recently bid in that property at public sale. The price paid was $84,864.04, to which must be added other obligations that will bring the investment up to about $130,000. The company will be reorganized, and we understand that Mr. Charles S. Benson, who has acted as receiver therefor, will be permanently retained as Manager.

THE Consumers Light and Power Company, of Middletown, N. Y., are considering the matter of the construction of a gas plant, which they may do under the terms of their franchise.

THE authorities of the borough of Summerville, which place is adjacent to Augusta, Ga., have granted to the Gas Light Company of Augusta the right to lay mains and supply gas to the residents, the selling rates not to exceed those charged in Augusta.

THE Freese Brothers, who recently sold their interest in the Bloomington (Ind.) Gas Company, have gone into the stone quarrying business at Bedford, Ind. It is hoped that their retirement from gas trading will not be permanent.

THE mains of the East Boston (Mass.) Gas Company are to be extended to and through the streets of the outlying district of Harbor View.

AT the annual meeting of the Lorain (O.) Gas Company the only change made in the management was the naming of Mr. A. E. Hay to succeed Mr. David D. Lewis on the Board of Directors.

BIDS for the public lighting of Columbus, O., in so far as that service is to be performed by means of "flat flame lamp, or oil, gasoline, naphtha, petroleum, or any similar compound or distillation, or by Welsbach incandescent gas lamp, natural or artificial gas, or Welsbach incandescent naphtha gas lamp," will be opened at 2 P.M. of next Friday. The contract is to run for 1 year.

MR. E. H. YORKE, Engineer to the Portland (Me.) Gas Light Company, writing to the JOURNAL under date of the 16th inst., says:

To the Editors AMERICAN GAS LIGHT JOURNAL: Whether it is true or not that "there is nothing new under the sun," I know not; but a method employed here, and which we have just discovered, for burning gas without the formality of allowing said gas to be registered by the gas meter, is new to me, I do affirm. And thinking that information as to how the trick is done might be of value to the fraternity (which must constitute my excuse for this communication) I herewith submit the facts, which are as follows: A consumer's complaining that he used about half as much gas and received bills of double the amount of those of his neighbor suggested that it might be possible that the neighbor's meter was slow. On this hypothesis the meter was changed, and when it reached the meter repairer, and he had taken off the top, the reason for its low registration was obvious, and the device employed for securing "free gas" was to be seen; that is, a drill had been run, at an angle, down through the inlet and outlet so that openings had been formed, thus making a direct passage for the gas from the inlet to the outlet. Whether this idea was original with that particuiar consumer, or whether it has widespread publicity (on the "q. t.") is an open question. At all events it is a method so simple for beating the gas companies as to constitute a new tax upon the vigilance of the gas manager, who must ever be alert to protect his company from that arch conspirator—the gas thief.

THE proprietors of the Warren (O.) Gas Light Company, have notified the authorities of their acceptance of the extension of its franchise, the main features of which were printed by us some time ago.

THE Charleston (S. C.) Consolidated Railway, Gas and Electric Company reports a net increase in earnings for August, 1901, as compared with the corresponding month of 1900, amounting to $3,198.78.

THE General Superintendent (Mr. McCuen) of Public Lighting for Baltimore, Md., has arranged his schedules for the ensuing year, under which it is seen that the lighting service for Maryland's chief city will cost $348,169 for the twelvemonth. Some of the items in the schedule are: 6,200 gas lamps at $21.40 each—$7.25 for gas supply and $14.15 for maintenance; 1,650 electric arc lamps, at $99.92 each; and 1,000 gasoline lamps at $28 each. In the schedules the request for gas for public buildings is figured at $500.

THE Portland (Ore.) Gas Company has filed notice of the issuing of a mortgage for $750,000, the proceeds of which are to go to the retiring of the old bond issues, the wiping out of the floating indebtedness and for expenditures shortly to be incurred on construction account. The bonds are to run for 50 years, and are to bear interest at the rate of 5 per cent. The Security Savings and Trust Company, of Portland, is the Trustee, and the interest returns are payable, in Portland, at the offices of the Trustee, or in New York, at the offices of the Franklin Trust Company.

A CORRESPONDENT in Bay city, Mich., forwards the following clipping which has to do with the application of the Hecla Portland Cement and Coal Company for the right to construct and operate a gas plant in West Bay city: "The undersigned respectfully ask for a franchise permitting them to carry on the business of manufacturing and selling gas to the inhabitants of West Bay city. We understand that a franchise has been adopted by your honorable body with the name of the grantee left blank, and that the matters pertaining thereto have been referred to a committee of your honorable body. We are prepared to

(*Continued on page* 494.)

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(*Concluded from page* 493.)

take the matter up with such a committee, or other representative of your body, at the earliest possible moment, and therefore respectfully ask that this communication be referred to such committee, or such representative, and that arrangements be made for an early meeting to take up negotiations."

"W. S. R.," writing from Bridgeport, Conn., under date of the 16th inst., says: "The ground floor and basement of Dr. I. de Ver Warner's new brick building, on the west side of Main street, south of Gilbert street, are being expressly fitted up for the headquarters, business offices, sale rooms and workshop of the united gas companies, the Bridgeport Gas Light Company and the Citizens Gas Company, which were bought recently by the same interests. The offices of the 2 concerns are now separate, but they will be united immediately after the superior court confirms the sale of the Citizens Company, which will be some time next month. The new offices will contain all the modern equipments of the business for which they will be used. They will be roomy and well lighted and ventilated, and will rank among the finest of their sort found anywhere. The Bridgeport Gas Light Company at present occupies well appointed offices on John street, while the office of the Citizens Company is in the Court Exchange building on Broad street. The Companies are necessarily running separately. A reorganization of the Citizens Company cannot be effected until the sale is ratified and, as it is the intention to consolidate the companies, the officers of the old Bridgeport Gas Light Company were kept in office until the reorganization can be made on the consolidated plan."

THE Town Council, of Berkley, Va., has assented to an amendment of the franchise of the National Gas Company, the promoters of which originally proposed to supply gas to Berkley through or from an independent plant. Under the amendment the Company may secure its supply from Norfolk or from Portsmouth, and distribute the same from holders erected in or near the town's corporate limits. Berkley is in Norfolk county, Va., at a point on the Elizabeth river opposite the city of Norfolk. It is quite a manufacturing center, and has a population not far from 5,000.

THE residents of Woodmont, Conn., have petitioned the New Haven Gas Light Company to extend its mains in their direction, and it is likely that the work will be done next spring. The named place is a noted summer resort on Long Island Sound, about midway of New Haven and Milford. It is not a summer resort in the ordinary sense of the term, as those who dwell there live in cottages, and there is small doubt that gas for cooking would find extensive use in Woodmont, from May until October.

THE proprietors of the Union Light, Heat and Power Company, who have succeeded to the separate gas and electric properties of Covington, Ky., have inaugurated a billing system that is causing much discontent—and there is little wonder that the practice has resulted in open-voiced objection. Here is a copy of one bill sent out the first week of the month, which purported to represent the value of the gas used by the consumer during the month of August. "* * * Your bill for the past month, with the discount off, is as follows: Gas for light, $1.20; for fuel, $3; electric light, ——; electric power, ——. Total, $4.20. This amount is now due and payable on or before the 10th inst., and unless paid on or before that date will be $5.31." What, under this billing system, is the use for or need of a meter? It is quite safe to predict that, before the snows of winter are upon us, the proprietors of the Covington Union Light, Heat and Power Company will have returned to the good, old way.

AT the annual meeting of the Worcester (Mass.) Gas Light Company the officers elected were: Directors, C. D. Lamson, J. H. Clarke, Albert Wood, A. G. Bullock, F. H. Dewey and S. B. Woodward; President, C. D. Lamson; Clerk and Treasurer, J. P. Hamilton. A dividend of 2 per cent. for the quarter was declared.

MR. O. N. GULDLIN, President of the Western Gas Construction Company, has reached home from a very satisfactory European trip. He is no shorter and is a trifle stouter.

THE properties of the Morris (Ills.) Gas Company were sold at public auction on the 13th inst. The purchaser was Mr. Loran H. Turner, of Chicago, whose bid was $10,550.

THE residents of Lynnhurst, Mass., have petitioned the Lynn Gas and Electric Company to put its mains through their territory.

THE authorities of New Orleans, La., are inquiring into the cost and probable economy of the construction of an electric lighting plant for operation on municipal account.

The Market for Gas Securities.

The deplorable death of the President brought out plainly at least one fact, which is that, in times of extraordinary disaster, the people of the United States can be safely depended on to maintain the demeanor and practice which are necessary to the general safety. No matter what may come six months from now, it is certain that order and confidence have been maintained in the time of direst peril, to such degree as to compel the admiration of all thinking men who yield allegiance to forms of government other than those of ours. And to the dead soldier and statesman may be accredited much in teaching to his contemporaries the value of prudence and slow justice, as exemplified in his ways to his ends. The market closed, last Friday (Sept 13th), in the gloom foreshadowing the President's death, and this Friday (Sept. 20th) no vulture-like note of those who would profit through calamity is heard.

The course of the market has been steadily on to sound recovery. Consolidated gas closed today at 222¾ to 223, and the volume of trading in it was fairly large. Continued gossip points to something positive shortly with respect to the Company's future relations with the Brooklyn Union Company. The latter shows unmistakable evidence of strength. Peoples, of Chicago, is in good demand, and Laclede common and preferred, are also in better favor. The transfer of control in the Wilmington (Del.) Company is assured, ⅓ of the shareholdings having accepted the offered selling price.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 23.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	222¾	223
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	305	315
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	108	108½
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River				
Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	135	..
Preferred	5,000,000	100	138	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	217
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	¾	⅞
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works..	450,000	100	30	40
" 1st Mtg. 5's	509,000	1,000	93	95
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	8
" " Bonds, 5's	5,250,000	1,000	69	72
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼

Cincinnati Gas & Elec. Co.	29,500,000	100	104¼	104¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	64	64½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	880,000	1,000	79	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	80	80½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	50	54
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	60
" Bonds, 6's	2 650,000	..	99½	101
Jackson Gas Co	250,000	50	65	70
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	92
Preferred	2,500,000	100	101	102
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	108¾	109
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46	46½
St. Paul Gas Light Co	1,500,000	100	60	63
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,465,000	1,000	86	88
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	93	96
Syracuse, N. Y.	1,750,000	100	17	19
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	302½	302¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	107	108½
Wilmington, Del.	600,000	50	232	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Sept. 11, 1901.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1901, to stockholders of record at the close of business, Sept. 30. Checks will be mailed.

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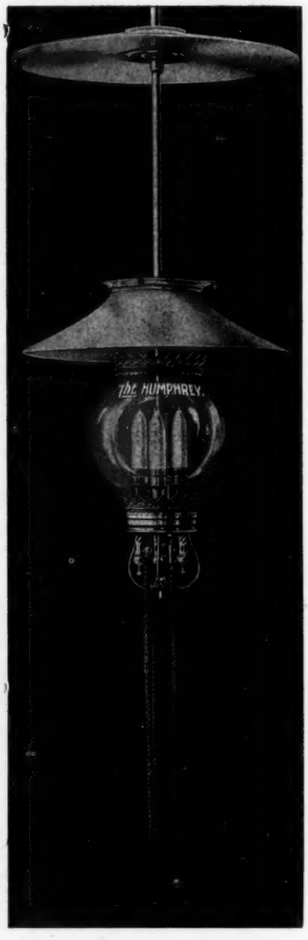

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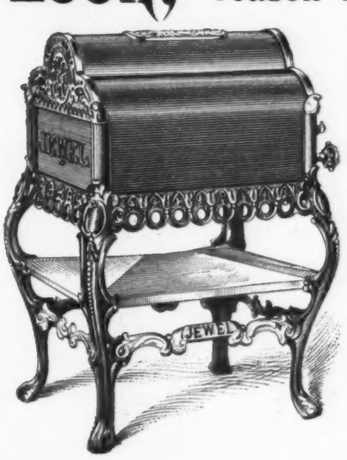

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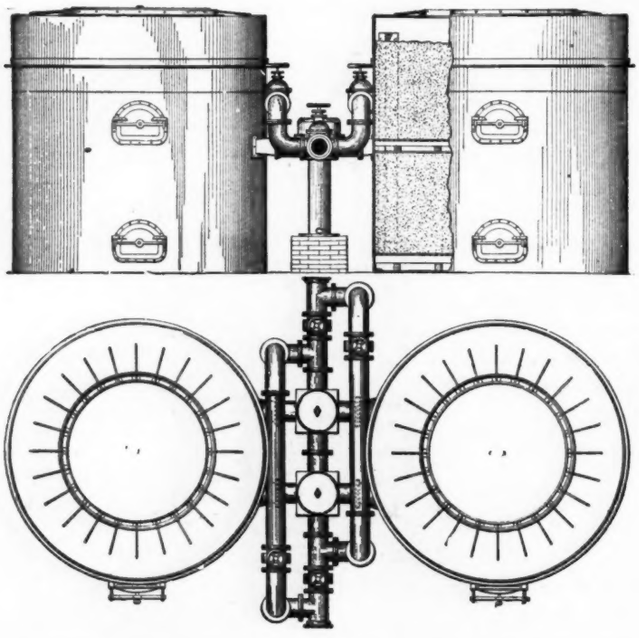

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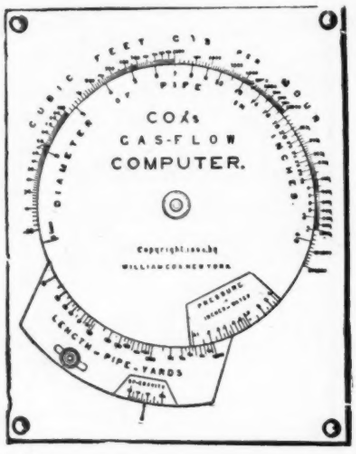

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	Cubic Feet Daily.
Blackburn, England	1,250,000
Windsor Street Works, Birmingham, England	2,000,000
Saltley Works, Birmingham, England	2,000,000
Colchester, England	300,000
Birkenhead, England	2,250,000
Swindon (New Swindon Gas Company), England	120,000
Saltley Works, Birmingham, England (Second Contract)	2,000,000
Windsor Street Works, Birmingham, England (Second Contract)	2,000,000
Halifax, England	1,000,000
Toronto	250,000
Ottawa	250,000
Toronto (Second Contract, Remodeled)	2,000,000
Lindsay (Remodeled)	125,000
Belleville	250,000
Ottawa (Second Contract)	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled)	250,000
Kingston, Pa.	125,000
Montreal	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract)	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, England (Second Contract)	300,000
York, England	750,000
Rochester, England	500,000
Kingston, Ont.	300,000
Crystal Palace District, England	2,000,000
Duluth, Minn.	300,000
Caterham, England	150,000
Enschede, Holland	150,000
Leicester, England	2,000,000
Buenos Ayres (River Platte Co.)	700,000
Burnley, England	1,500,000
Kingston-on-Thames, England	1,750,000
Accrington, England	500,000
Tonbridge, England	300,000
Stretford, England	500,000
Oldbury, England	300,000
Saltley Works, Birmingham, England (Third Contract)	2,000,000
York, England (Second Contract)	750,000
Rochester, England (Second Contract)	500,000
Newport, Monmouth, England	250,000
Todmorden, England	500,000
Tokio, Japan	1,000,000
Nelson, British Columbia (Complete Gas Works).	
Orders received in 1901 to March 1, 3,500,000 cu. ft. daily.	
Malton, England	150,000
Smethwick, England	500,000

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Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

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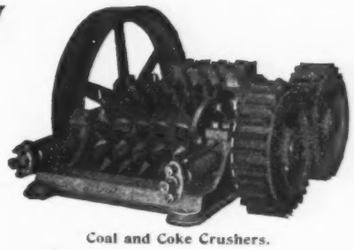
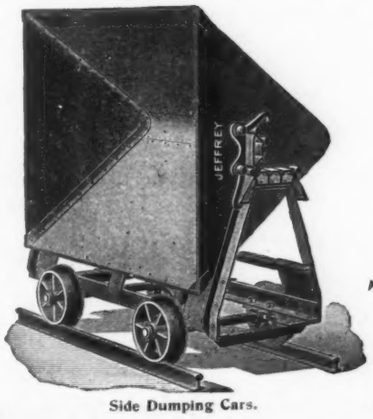


Coal and Coke Crushers.



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That every "ALAVA" CENTER-SUPPORT cap mantle is guaranteed to be everything that is claimed for it. . . . . .

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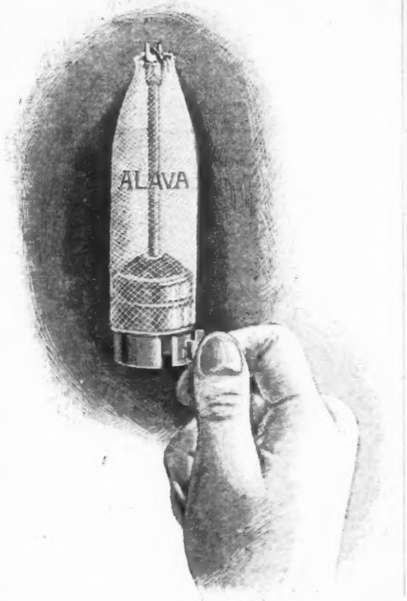

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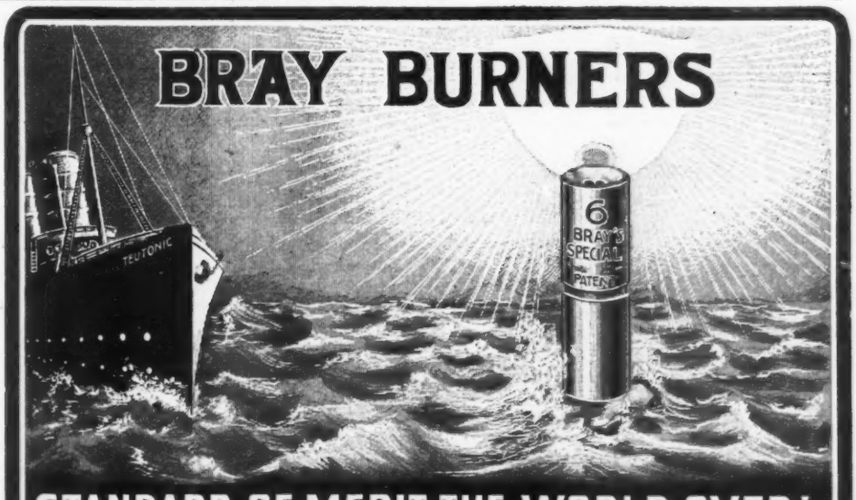

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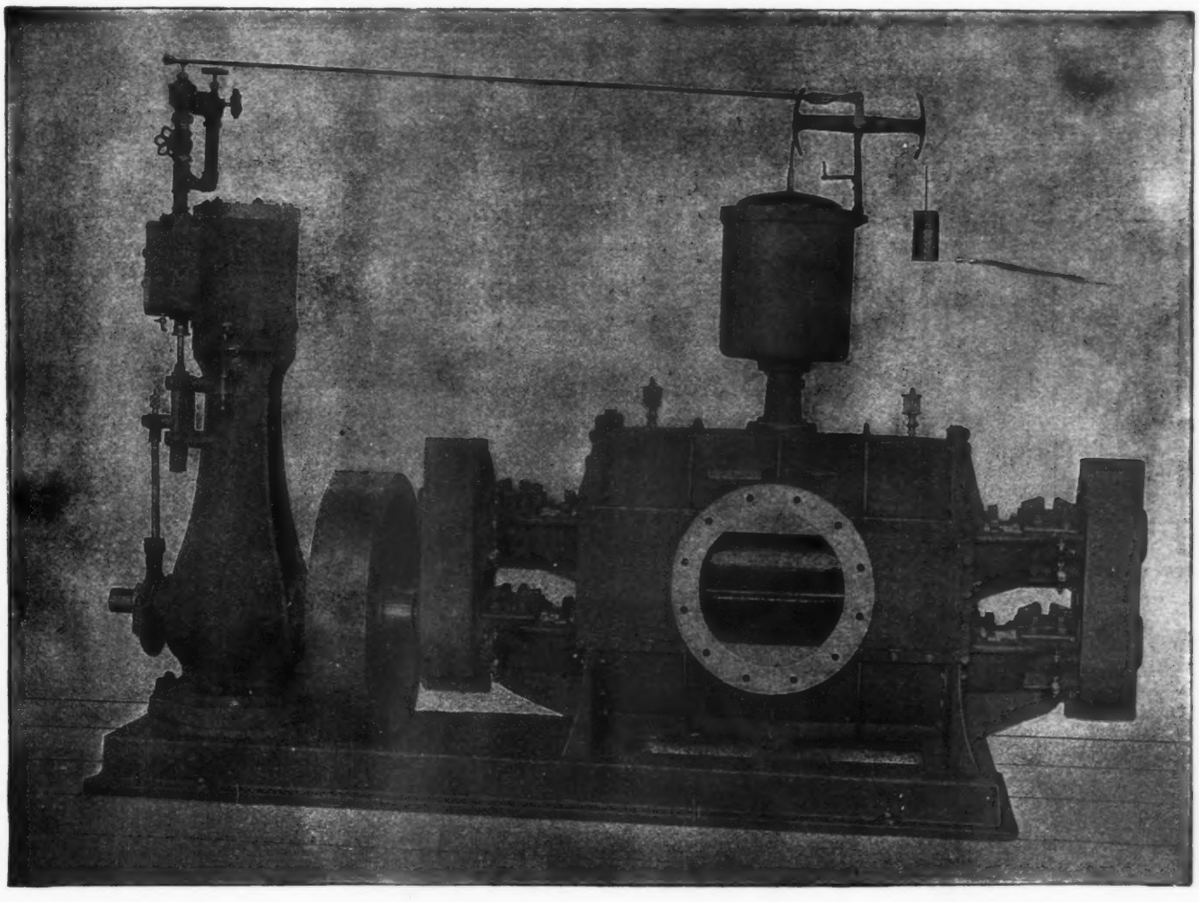
OUR GAS GOVERNOR IS MAKING FRIENDS EVERY DAY.



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Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

THREE SLOTS.

THE 3-SLOT ADJUSTMENT of the ATLAS PIPE WRENCH is the simplest and most effective adjustment of any PIPE WRENCH manufactured. No exasperating delays caused by threads or nuts being burred, rusted or clogged with dirt. THE SLOT ADJUSTMENT SAVES ALL THAT TROUBLE. The "ATLAS" grips the pipe quickly and positively, and releases readily

IT NEVER LOCKS.

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Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

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FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

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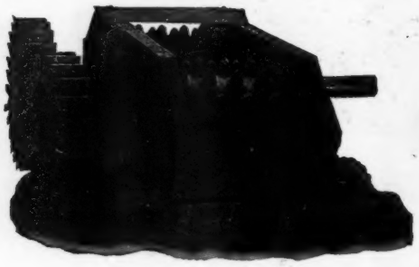

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Tilting Coal and Coke Cars, Breaker Rolls, Power Transmitting Machinery.

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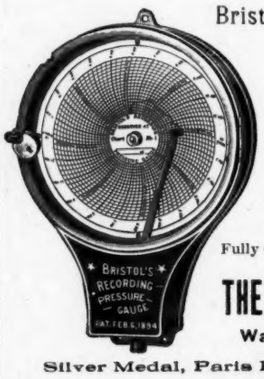

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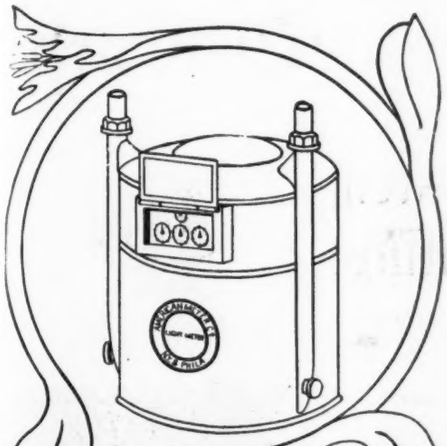

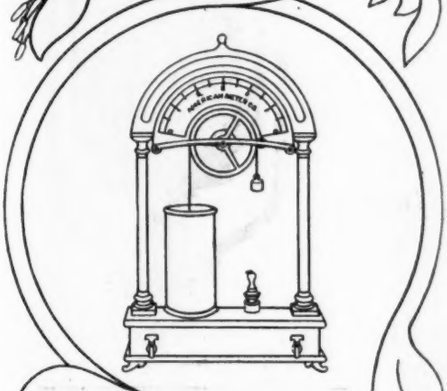

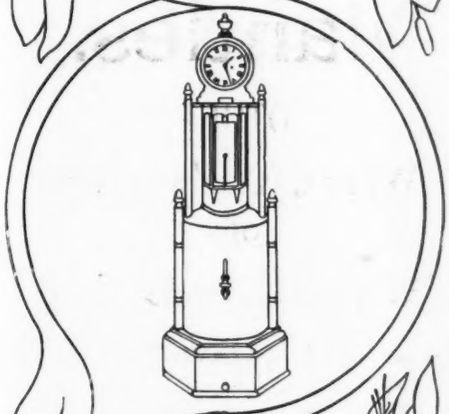

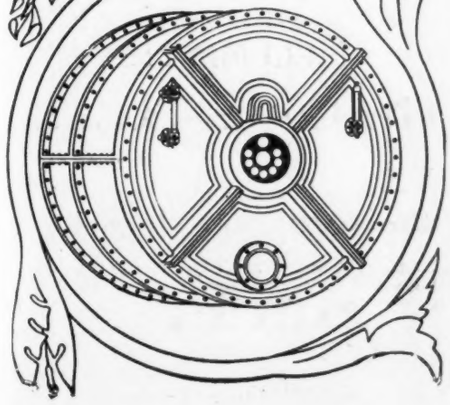

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SAN FRANCISCO.

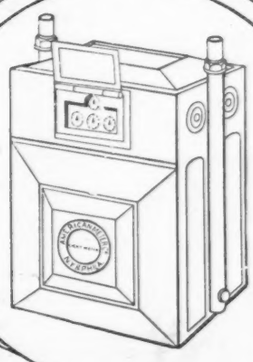
PUBLIC LIGHTING TABLE.

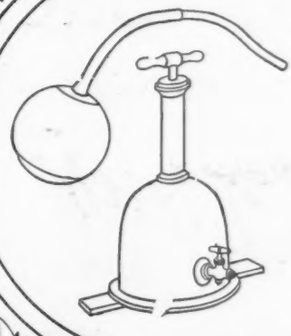
OCTOBER, 1901.

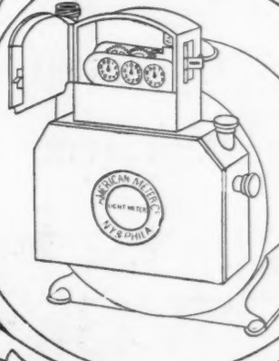
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	6.10 PM	9.10 PM	5.30	5.00
Wed.	2	6.10	10.00	5.30	5.00
Thu.	3	6.10	11.00	5.30	5.00
Fri.	4	6.10 LQ	12.10 AM	5.30	5.00
Sat.	5	6.10	1.10	5.30	5.00
Sun.	6	6.00	2.10	5.30	5.00
Mon.	7	6.00	3.10	5.30	5.00
Tue.	8	6 00	4.20	5.20	5.10
Wed.	9	6 00	5.00	5.20	5.10
Thu.	10	6.00	5.00	5.20	5.10
Fri.	11	6.00	5.00	5.20	5.10
Sat.	12	6.00 NM	5.00	5.20	5.10
Sun.	13	5.50	5.10	5.20	5.10
Mon.	14	5.50	5.10	5.20	5.10
Tue.	15	5.50	5.10	5.10	5.20
Wed.	16	5.50	5.10	5.10	5.20
Thu.	17	7.40	5.10	5.10	5.20
Fri.	18	8.30	5.10	5.10	5.20
Sat.	19	9.30	5.10	5.10	5.20
Sun.	20	10.30 FQ	5.20	5.10	5.20
Mon.	21	11.30	5.20	5.10	5.20
Tue.	22	12.30 AM	5.20	5.00	5.30
Wed.	23	1.40	5.20	5.00	5.30
Thu.	24	2.50	5.20	5.00	5.30
Fri.	25	4.00	5.20	5.00	5.30
Sat.	26	No L.	No L.	5.00	5.30
Sun.	27	No L. FM	No L.	5.00	5.30
Mon.	28	No L.	No L.	5.00	5.30
Tue.	29	5.30 PM	7.50 PM	4.45	5.35
Wed.	30	5.30	8.50	4.45	5.35
Thu.	31	5.30	9.50	4.45	5.35

TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45



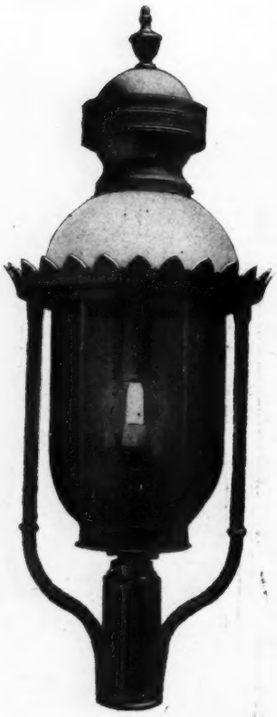




NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

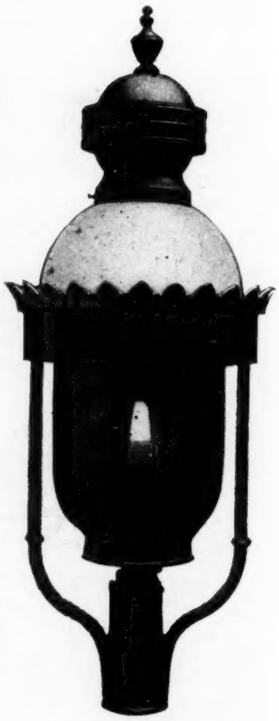
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.



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Welsbach Famous Mantles.

THE INCOMPARABLE

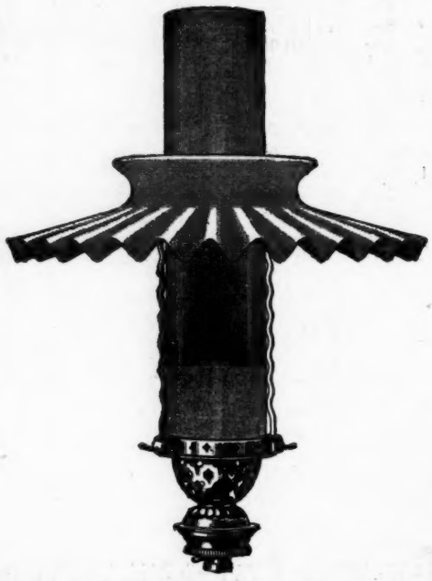
"Yusea" Welsbach Mantle

FINEST EXAMPLE

OF INCANDESCENT

GAS LIGHT

EVER EXHIBITED.



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The Lowest Cost.

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THE STANDARD DOUBLE SUPERHEATER

LOWE WATER GAS APPARATUS.

Under Contract, 1901:

Number of Sets to August 1, 1901, - - - - - - 27

Total Daily Capacity, - - - - 28,200,000 Cubic Feet.

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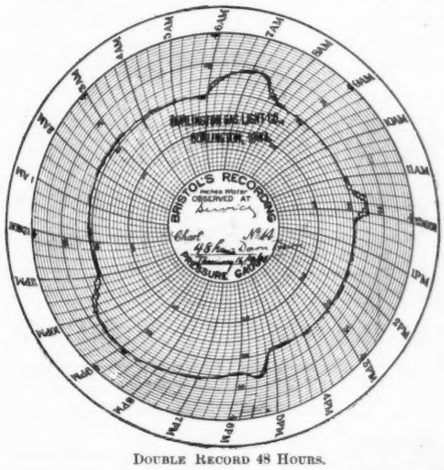

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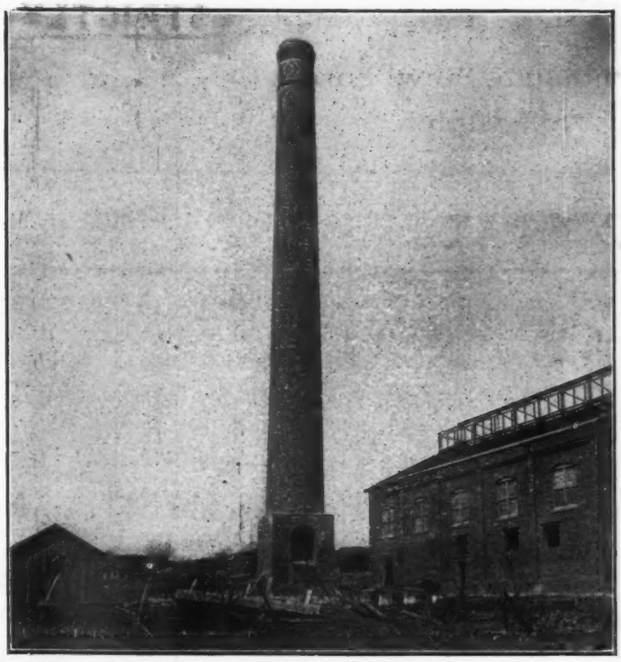

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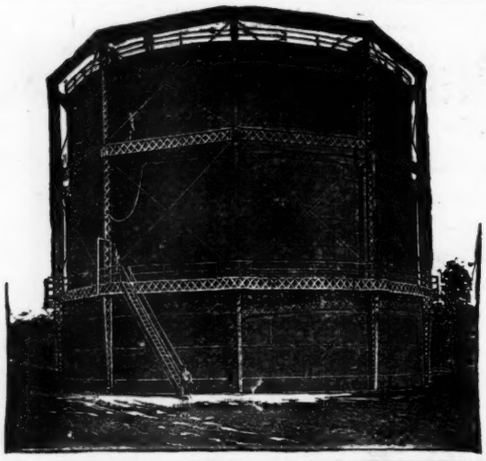

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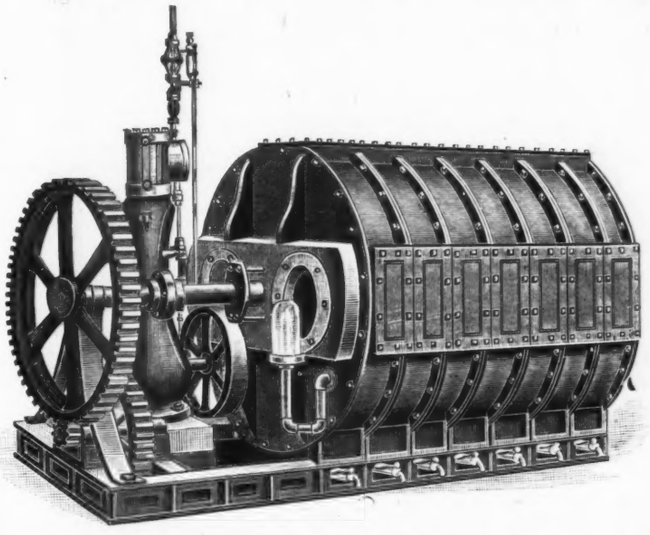

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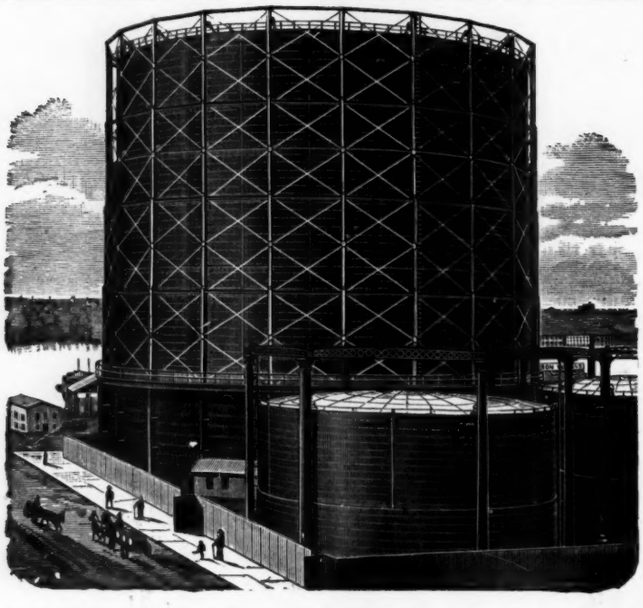

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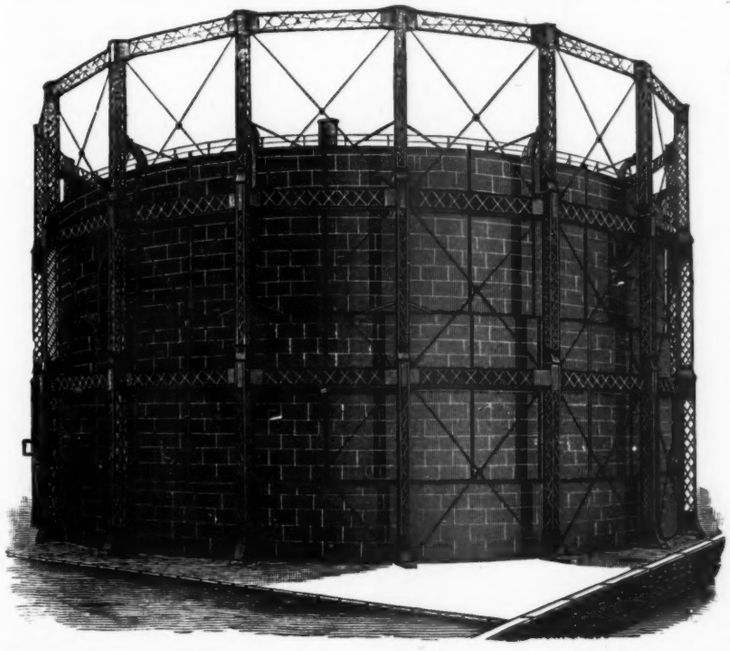

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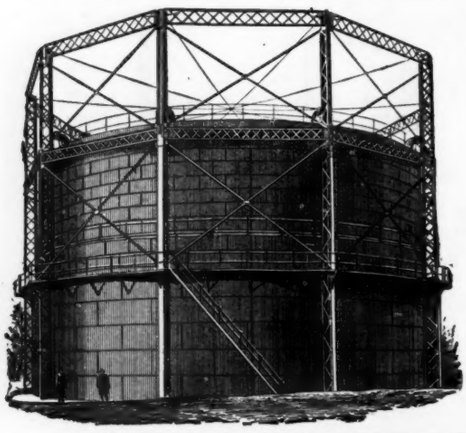

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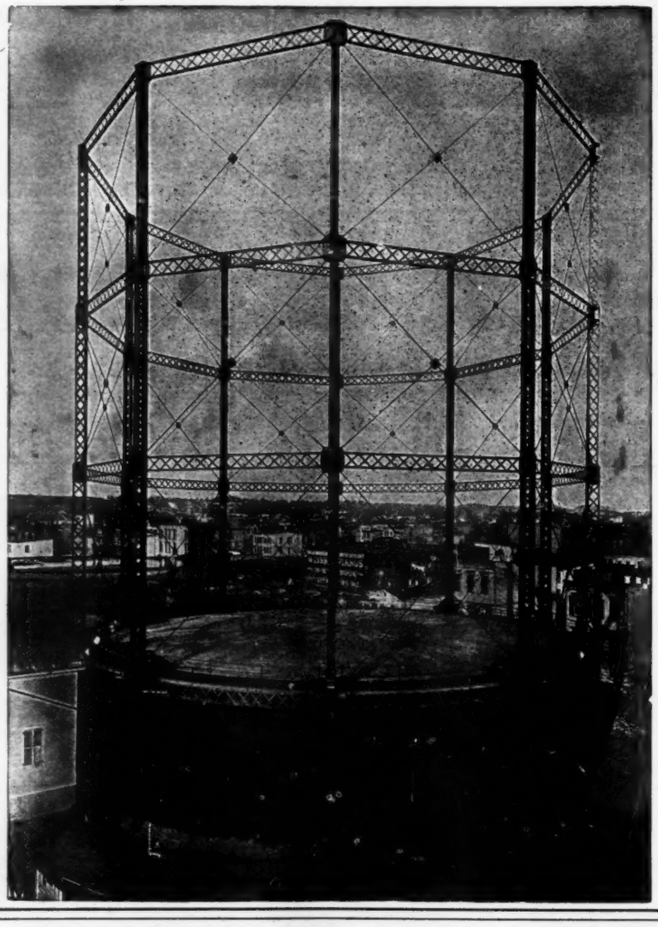

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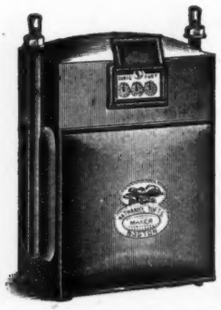

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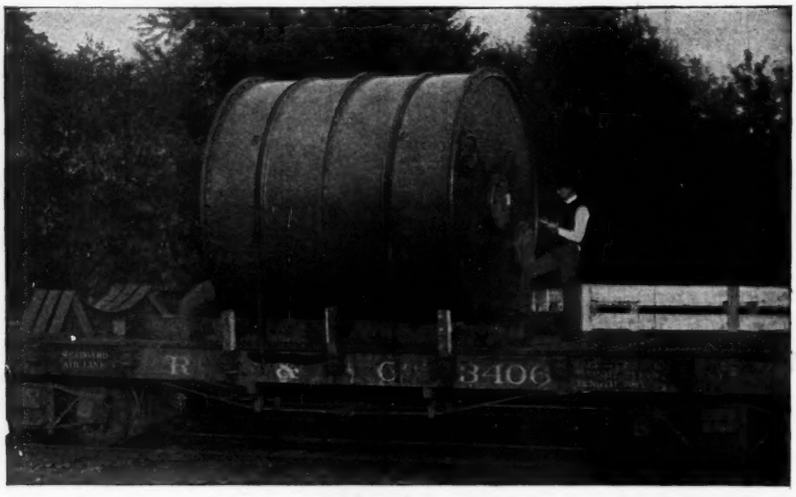

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